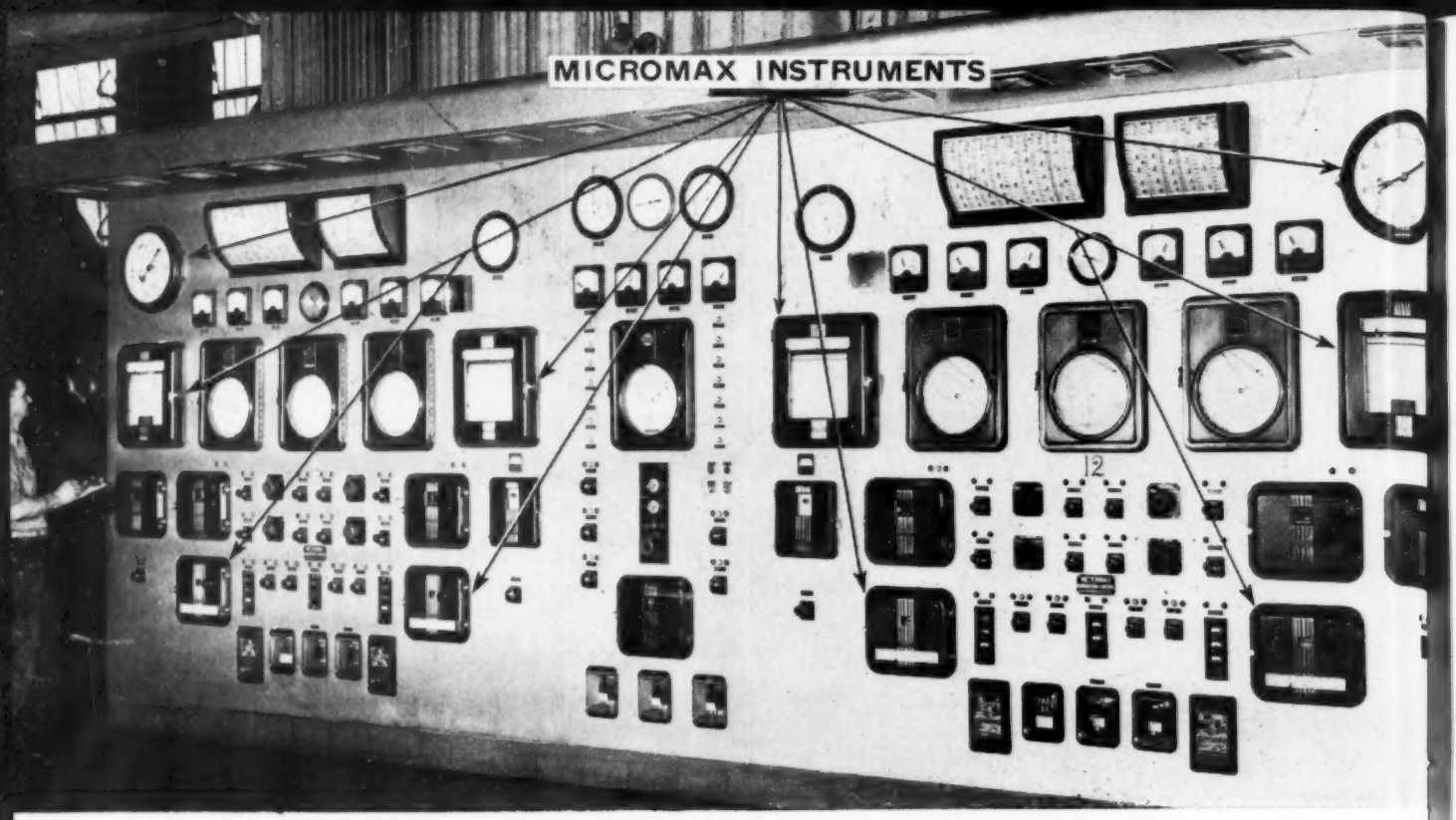
# POWER

A McGRAW-HILL PUBLICATION DEVOTED TO GENERATION, TRANSMISSION AND APPLICATION OF ALL THE POWER SERVICES



JULY 1947

THIS ISSUE: First of a series on preventing air pollution, a top-priority job for power engineers, p 64; supercharging puts 500 kw in space provided for 300 kw, p 83; useful tips on specifying equipment, p 89 • TABLE OF CONTENTS, p 59




# SIX STEAM-PLANT CONDITIONS

## Can Be Dependably Recorded By MICROMAX Equipments

Micromax Electric Control for Superheat and pH can be instantly switched from manual to automatic and vice-versa. On manual setting, as on automatic, it shows position of remote valve—a great help to the operator.

When power-plant instruments are being considered, it pays to look carefully at what's on *each end* of the leadwires! For the accurate, dependable nature of the job which Micromax equipments do is partly credited to the Micromax Recorder and partly to the gas-analysis cell, thermocouple or other Primary Element at the opposite end of the instrument's leadwire. Here are some highlights of results:

$CO_2$ Recording is in the form of a *continuous* record; is as dependable as temperature recording; and requires hardly any more attention to the equipment. See Catalog N-91-163.

Temperature Recording and Superheat Control. Integrated design from Thermohm or thermocouple to damper-drive gives full advantage of Micromax accuracy; plus flexible, easy-to-use Control. Catalogs N-33-163 and N-33-163 (1).

Conductivity Control for condensate calls attention whenever a condenser starts to leak. Catalog N-95-163.

Centrimax Flowmeter with Micromax Recorder meets need of power-industry spokesmen for extraordinary precision in determining overall efficiency. Catalog N-28-160.

Smoke Density Recorder puts the story on big Micromax charts, in convincing detail and accuracy. Catalog N-93-163.

Micromax pH Control for water is spreading rapidly because of sensitivity, accuracy and easy-to-use features. Catalog N-96(1)

LEEDS & NORTHRUP COMPANY, 4910 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

Jrl Ad N-163(14)

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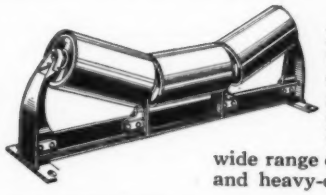
# LINK-BELT Conveyors

## Solve the Handling Problems of Industry

## HERE ARE SOME OF THE MANY TYPES OF L-B CONVEYORS



### BELT CONVEYORS

Link-Belt makes all types of troughing, flat-roll, return and self-aligning idlers, including all accessories, such as trippers, belts, pulleys, bearings, take-ups, etc., for handling a wide range of materials, for light, medium and heavy-duty service.

### BULK-FLO Conveyor-Elevator-Feeder

Simple . . . Versatile . . . Compact . . . Enclosed. Economically handles flowable, granular, crushed, ground or pulverized materials of a non-abrasive, non-corrosive nature in a continuous mass, horizontally, vertically or on an incline, in a single unit. Bulk-Flo is easily adaptable to practically any surroundings.

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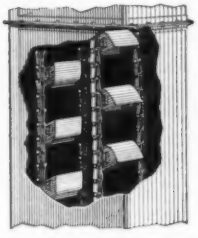
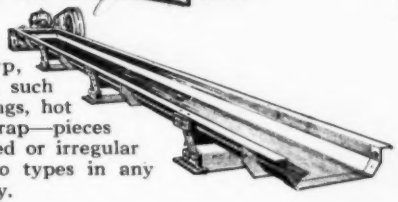


### BUCKET ELEVATORS

If your conditions call for the use of a bucket elevator, let Link-Belt show you the most efficiently performing size and type for your needs. Included are all accessories—chain, buckets, casings, take-ups, drives, etc.

### OSCILLATING-TROUGH CONVEYORS

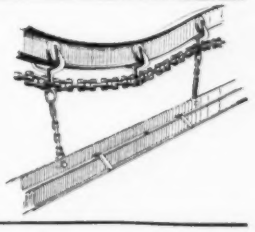


An economical conveyor for handling sharp, abrasive, hot materials, such as castings, metal turnings, hot shakeout sand, steel scrap—pieces that are hot, oily, jagged or irregular in shape. Made in two types in any length, for any capacity.

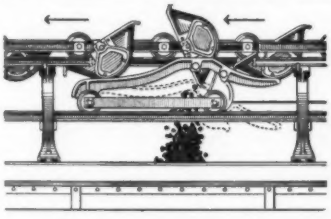
### SCREW CONVEYORS

Link-Belt manufactures Helicoid, the original continuous flight screw conveyor. Other Link-Belt screw conveyor equipment includes sectional-flight, ribbon and paddle conveyors, as well as a complete line of accessories, such as collars, couplings, hangers, troughs, box ends, flanges, thrusts and drives.

### OVERHEAD CONVEYORS



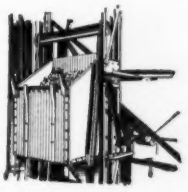
Link-Belt overhead conveyors put ceilings to work, save valuable floor space, prevent congestion, interference and damage to materials in transit. Can be installed in existing plants without costly remodeling.



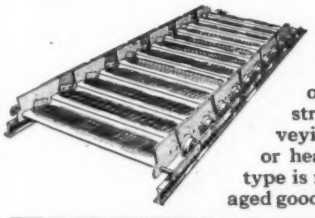
### BUCKET CARRIERS AND ELEVATORS

There is a type of Link-Belt bucket carrier and elevator for every service—horizontal, vertical or inclined—for handling all kinds of materials at desired capacities.

### SKIP HOISTS



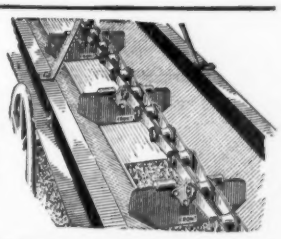
The skip hoist is especially well adapted for making high lifts, elevating abrasive or corrosive materials, and the handling of large lumps, as well as fines. Link-Belt skips are economically applicable to large or small capacities.



### APRON & SLAT CONVEYORS

The steel-pan type, consisting of pans mounted on multiple strands of chain, is ideal for conveying fine or lumpy materials, light or heavy-duty service. The wood-slat type is recommended for handling packaged goods, parts, crates, barrels, boxes, etc.

### FLIGHT CONVEYORS

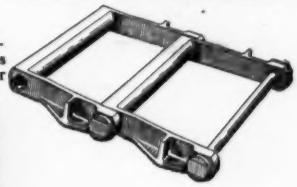


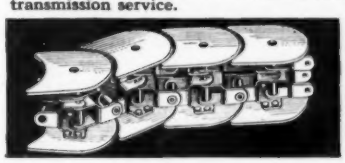
Made in many types for fine or lump materials in single or double chain designs, some arranged to slide, others carried on rollers, for horizontal or inclined operation.

Conveyors and elevators are called upon to do an endless variety of tasks. Each presents its own problems . . . each requires its own solution. From the design to the erection of your conveyor system . . . Link-Belt offer experience, backed by thousands of installations and foresight that has established their reputation as pioneers in the field of continuous movement of materials.

### CHAIN CONVEYORS

The most complete line of chains, sprockets and attachments of all types and sizes for every conveying, elevating and power transmission service.

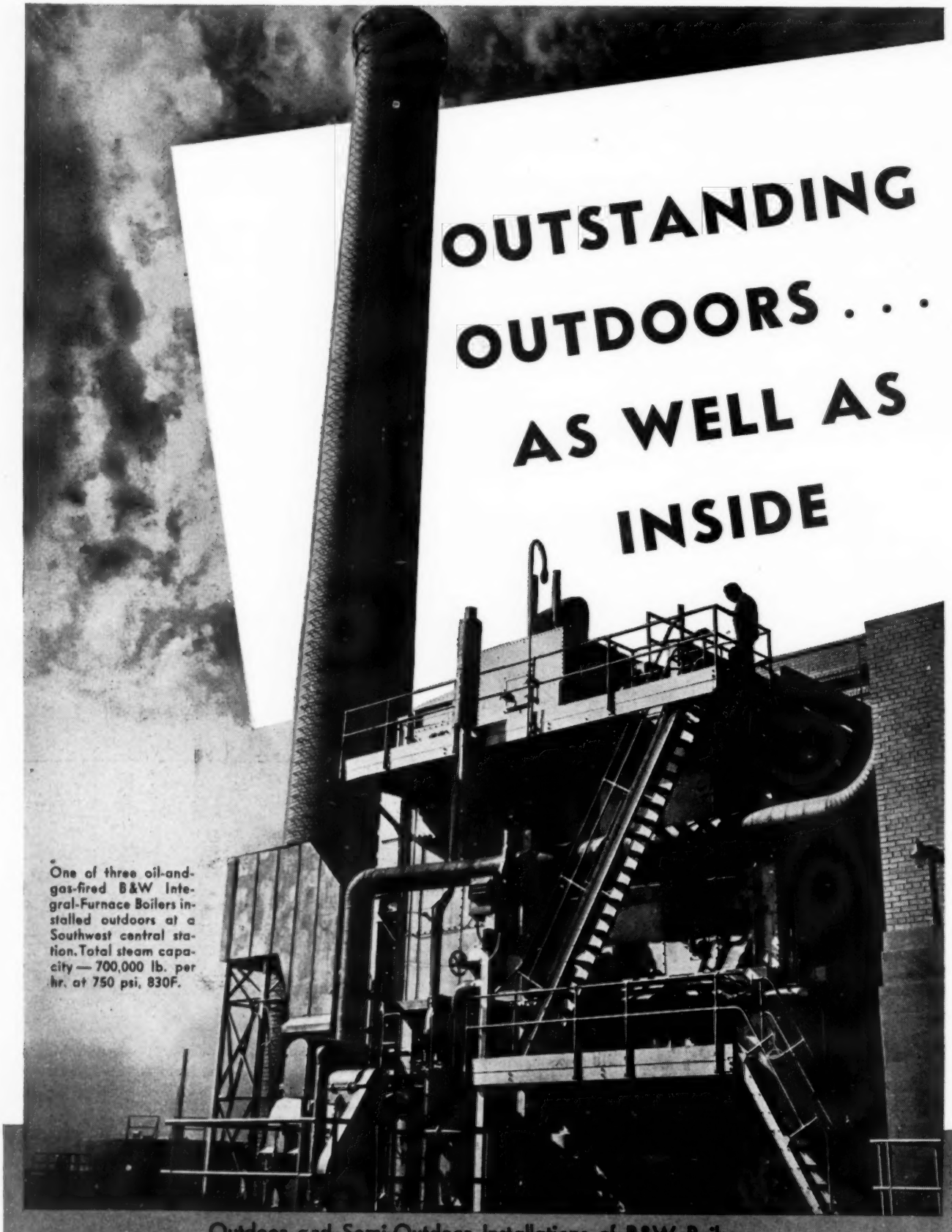




## LINK-BELT COMPANY

***The Leading Manufacturer of Conveying and Mechanical Power Transmission Machinery***

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices, Factory Branch Stores and Distributors in Principal Cities. 10,568



# OUTSTANDING OUTDOORS . . . AS WELL AS INSIDE

One of three oil-and-gas-fired B&W Integral-Furnace Boilers installed outdoors at a Southwest central station. Total steam capacity — 700,000 lb. per hr. at 750 psi, 830F.

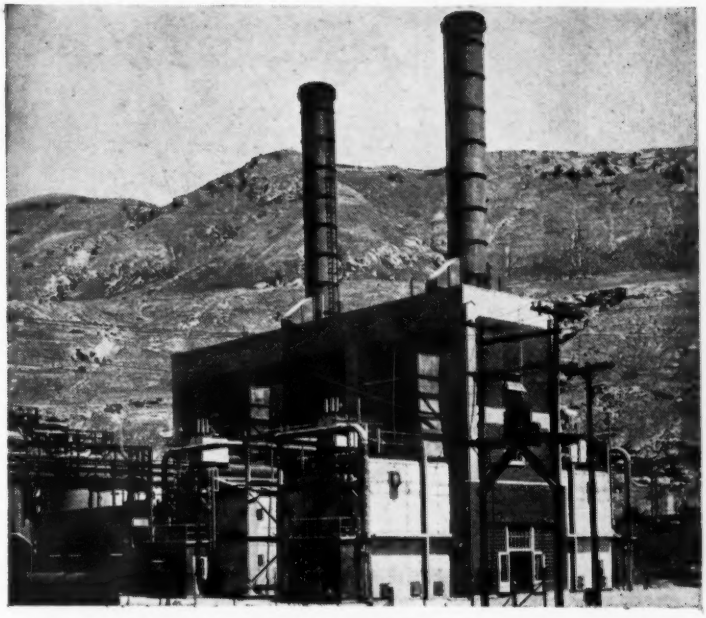
**Outdoor and Semi-Outdoor Installations of B&W Boilers:**

**By Industry:** Central Station, Refineries, Chemical Plants, Rubber Factories, Manufacturing Plants.

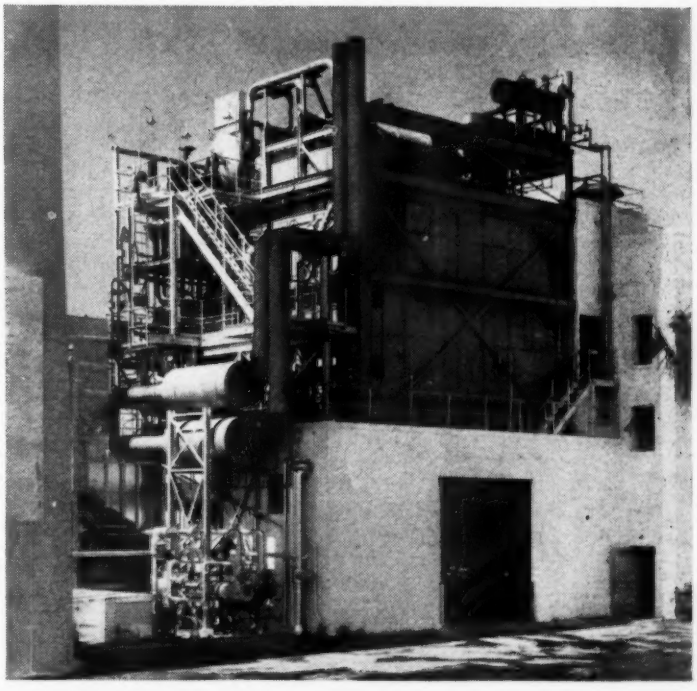
**By Locations:** Arizona, California, Colorado, Florida, Iowa, Kentucky, Louisiana, New Jersey, New Mexico, New York, Oklahoma, Oregon, Pennsylvania, Texas, Utah, Argentina, Columbia, Cuba, Mexico, Netherland West Indies.

Outdoor and semi-outdoor installations are an old story with B&W Boilers. They have been identified with these types of power plants since their inception over 15 years ago. More than 100 Integral-Furnace, Radiant, and Stirling units with an aggregate steam capacity of 17 million lb. per hr. are now in service or on order. Individual steam capacities range from 25,000 to 500,000 lb. per hr., with pressures up to 1500 psi and temperatures up to 950 F. Fuels include pulverized coal, gas, oil, wood, and industrial refuse.

Installations are located in fifteen different states—North, East, South, and West—and in several countries abroad. Exposed to all kinds of climatic conditions—snow, rain, high winds, temperatures from —30 F to over 100 F—these B&W boiler installations are giving the same high standards of performance and economical operation that have made B&W boilers the leading choice for conventional indoor plants for 80 years.



Four 65,000 lb. per hr. B&W Integral-Furnace Boilers installed outdoors at a Utah refinery. They are fired with oil and gas.



A 200,000 lb. per hr. oil-fired B&W Integral-Furnace Boiler installed outdoors at a new central station in Florida. Unit is designed for future use of pulverized-coal.

G-302 T

B&W

Water-Tube Boilers, for Stationary Power Plants, for Marine Service . . . Water-Cooled Furnaces . . . Superheaters . . . Economizers . . . Air Heaters . . . Pulverized-Coal Equipment . . . Chain-Grate Stokers . . . Oil, Gas and Multifuel Burners . . . Seamless and Welded Tubes and Pipe . . . Refractories . . . Process Equipment.

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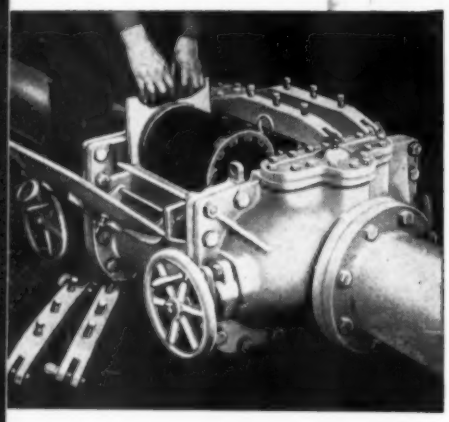
HERE COMES TROUBLE BUT HERE'S



## TWIN BASKETS MEAN NON-STOP SERVICE

When a basket needs cleaning, gate valves switch the flow to the twin basket. Backing off a few nuts releases the cover, and the fouled basket is removed, dumped, and replaced ready for its turn of duty again. In larger twin strainers the gate valves are motor operated.

## NEW DEVELOPMENTS IN ELLIOTT SELF-CLEANING STRAINERS

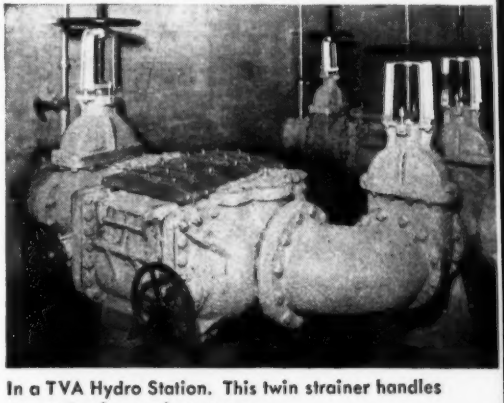
Used for removing foreign matter from water which has already been screened or strained. Motor-driven rotating element blanks off successive sections, which are cleared by back-flushing. Drive mechanism is powerful but small and compact, requiring low head-room. When necessary, straining units can be removed and replaced without removing the cage. This strainer in normal service requires no attention beyond general observation. Hundreds now in successful service, in sizes from 4" to 24".

# WHERE TROUBLE STOPS

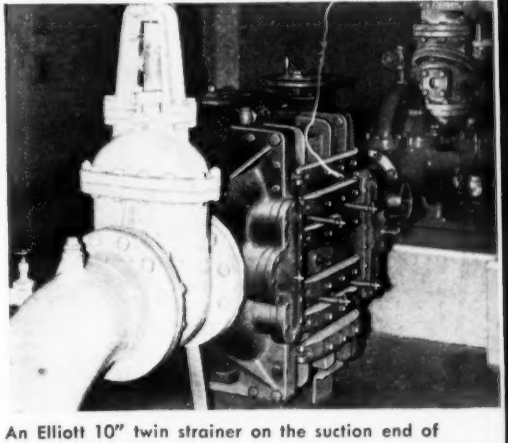
IN the service water system a piece of dead leaf is TROUBLE. So is a shred of cloth, a particle of scrap paper, a few loose fibers of pump packing. All are water-borne threats to continued power plant operation, and every engineer knows what they can do to cylinder walls, valve seats, and similar critical parts. Most engineers know the answer, too—Elliott strainers, trouble-averters for almost two generations of power plant engineers. Elliott has supplied so many thousands of strainers for power and process plants during the past forty-five years, you might almost say that American industry depends upon Elliott strainers. Certainly if all these strainers were to cease operation, a good percentage of the power facilities of America would soon be in serious difficulties.

Elliott strainers are built in types for use with any liquid, sizes from 2" to 30" (pipe). *Twin strainers* for non-stop service, one cylinder always working while the other is cleaned . . . *Single strainers,* the one-cylinder version of the twin strainer . . . *oil strainers* (a special type of twin strainer) and . . . *Self-cleaning strainers,* a late Elliott development, recently further improved. Write us for detailed data on any of these.

**ELLIOTT TWIN STRAINERS** sometimes catch a mess of fish or eels, as shown in this photo of a dumped basket. They'll catch anything that doesn't belong in a water line.



In a TVA Hydro Station. This twin strainer handles raw water for service pumps.



An Elliott 10" twin strainer on the suction end of a screen wash pump.

Elliott COMPANY

*Accessories Dept.,* JEANNETTE, PA.

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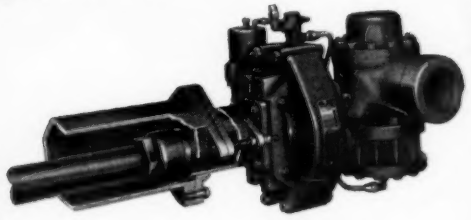
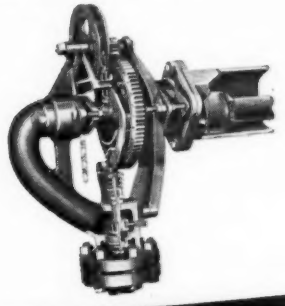
A-296

# Typical Central Stations Installed or Under

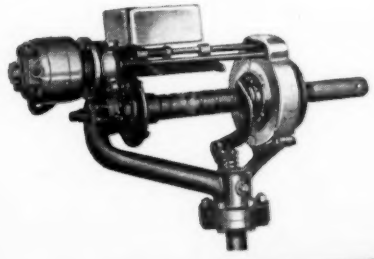

**DIAMOND Model A2E Automatic Air Puff Soot Blowers**



**DIAMOND Model G9B Soot Blowers**



**DIAMOND Model IR Short Retracting Soot Blowers**




Compiled by B G A Skrotzki
*Assistant Editor*

| Customer | Location | Plant Name | Consulting Engineer | Boiler Mfr | Number | Steam Pressure, Lb | Steam Temp, Deg F | Evaporation, Lb | Type | Fuel | Furnace Volume, Cu Ft | Heating Surface, Sq Ft | Superheater Surface, Sq Ft | Economizer Surface, Sq Ft | Air Heater Surface, Sq Ft | Stoker Mfr | Number | Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1000 PSI AND ABOVE** | | | | | | | | | | | | | | | | | | |
| Consolidated Edison Co of N Y | Bronx, NYC, N. Y. | Sherman Creek | | | | | | | | | | | | | | | | |
| Pacific Gas & Electric Co | Oleum, Calif | Oleum | | | | | | | | | | | | | | | | |
| Columbus & So. Ohio El Co | Nr Columbus, Ohio | Walnut | United Lt & Pwr Serv | | | | | | | | | | | | | | | |
| Commonwealth Edison Co | Chicago, Ill | Fisk | Sargent & Lundy | | | | | | | | | | | | | | | |
| Illinois Northern Utilities Co | Dixon, Ill | Dixon | Sargent & Lundy | | | | | | | | | | | | | | | |
| New Orleans Pub Serv Inc | New Orleans, La | Industrial Canal | Ebasco Services | | | | | | | | | | | | | | | |
| Pennsylvania Power & Light Co | Hauto, Pa | Hauto | Ebasco Services | | | | | | | | | | | | | | | |
| Pennsylvania Power & Light Co | Nr Sunbury, Pa | Sunbury | Ebasco Services | | | | | | | | | | | | | | | |
| **800 TO 999 PSI** | | | | | | | | | | | | | | | | | | |
| Columbus & So. Ohio El Co | Nr Columbus, Ohio | Picway | United Lt & Pwr Servic | | | | | | | | | | | | | | | |
| Wisconsin Pwr & Lt Co | Beloit, Wis | Blackhawk | Sargent & Lundy | | | | | | | | | | | | | | | |
| Consolidated Edison Co of N Y | Bronx, NYC, N. Y. | Hell Gate | | | | | | | | | | | | | | | | |
| The Ohio Public Service Co | Warren, Ohio | Mahoningside | Electric Advisers | | | | | | | | | | | | | | | |
| Connecticut Lt & Pwr Co | Devon, Conn | Devon | United Engrs | | | | | | | | | | | | | | | |
| Gulf Power Co | Pensacola, Fla | Pensacola | Comm & So. Corp | | | | | | | | | | | | | | | |
| Staten Island Edison Corp | Travis, S. I., N. Y | Arthur Kill | Gilbert Assoc | | | | | | | | | | | | | | | |
| El Paso Electric Co | New Mexico | Rio Grande | Stone & Webster | | | | | | | | | | | | | | | |
| Consol Gas, El Lt & Pwr Co, Balto | Turner, Md | Riverside | | 12-42 | 850 | 900 | 1 | 550 | BW | 6.2 | 7.36 | 28.95 | 23.4 | | DB | | | |
| | | | | 4-44 | 850 | 900 | 1 | 550 | BW | 6.2 | 7.36 | 28.95 | 23.4 | | DB | | | |
| The Detroit Edison Co | Marysville, Mich | Marysville | | 1942 | 850 | 925 | 1 | 440 | CE | 7.10 | 6.58 | 27.83 | 20.0 | | DB | | | |
| | | | | 1947 | 850 | 925 | 1 | 440 | CE | 7.10 | 6.58 | 27.83 | 20.0 | | DB | | | |
| Houston Ltg & Pwr Co | Nr Houston, Texas | W Junction | Ebasco Services | 6-43 | 850 | 900 | 1 | 400 | RS | | | | | | | | | |
| Illinois Power Co | Havana, Ill | Havana | Sargent & Lundy | 12-46 | 850 | 900 | | | | | | | | | | | | |
| Indianapolis Pwr & Lt Co | Indianapolis, Ind | Harding St | Gibbs & Hill | | | | | | | | | | | | | | | |
| New Orleans Pub Serv Inc | New Orleans, La | Market St | Ebasco Services | | | | | | | | | | | | | | | |
| Southwestern Public Serv Co | Borger, Texas | Riverview | | | | | | | | | | | | | | | | |
| Tennessee Valley Authority | Spring City, Tenn | Watts Bar | Chas T Main | | | | | | | | | | | | | | | |
| The Ohio Public Service Co | Shadyside, Ohio | R E Burger | Electric Advisers | | | | | | | | | | | | | | | |
| Iowa-Illinois Gas & El Co | Moline, Ill | Moline | United Service Co | | | | | | | | | | | | | | | |
| Iowa-Illinois Gas & El Co | Davenport, Iowa | Riverside | United Service Co | | | | | | | | | | | | | | | |
| Madison Gas & Electric Co | Madison, Wis | Blount St | | | | | | | | | | | | | | | | |
| Southern Indiana Gas & El Co | Evansville, Ind | Ohio River | Comm & So Corp | | | | | | | | | | | | | | | |
| **600 TO 799 PSI** | | | | | | | | | | | | | | | | | | |
| Public Service Co of Ind, Inc | Terre Haute, Ind | Dresser | Sargent & Lundy | | | | | | | | | | | | | | | |
| Sioux City Gas & Elec Co | Sioux City, Iowa | Kirk | B F Wood | | | | | | | | | | | | | | | |
| Pennsylvania Electric Co | Seward, Pa | Seward | Gilbert Assoc | | | | | | | | | | | | | | | |
| Potomac Electric Pwr Co | Washington, D. C | Buzzard Pt | Stone & Webster | | | | | | | | | | | | | | | |
| Wisconsin Public Service Corp | Green Bay, Wis | Bayside | Public Ut Engr & Serv | | | | | | | | | | | | | | | |
| Central Illinois El & Gas Co | Rockford, Ill | Rockford | Stone & Webster | | | | | | | | | | | | | | | |
| New York State El & Gas Corp | Bainbridge, N. Y | Jennison | Gilbert Assoc | | | | | | | | | | | | | | | |
| Pacific Gas & Electric Co | Eureka, Calif | Station B | | | | | | | | | | | | | | | | |
| Eastern Shore Pub Serv of Va | Vienna, Md | Vienna | United Engrs & Con | | | | | | | | | | | | | | | |
| Dallas Pwr & Lt Co | Nr Dallas, Texas | Mountain Creek | Ebasco Services | | | | | | | | | | | | | | | |
| Louisville Gas & El Co | Louisville, Ky | Canal | Public Ut Engr & Serv | | | | | | | | | | | | | | | |
| Louisville Gas & El Co | Louisville, Ky | Paddys Run | Public Ut Engr & Serv | | | | | | | | | | | | | | | |
| Public Service Co of Okla | Tulsa, Okla | Tulsa | Sargent & Lundy | | | | | | | | | | | | | | | |
| Superior Water, Lt & Pwr Co | Superior, Wis | Winslow | | | | | | | | | | | | | | | | |
| Gulf States Utilities Co | Baton Rouge, La | Louisiana | Stone & Webster | | | | | | | | | | | | | | | |
| Interstate Pwr Co | Clinton, Iowa | Beaver Channel | Sargent & Lundy | | | | | | | | | | | | | | | |
| Southwestern Public Serv Co | Carlsbad, N. M | Carlsbad | | | | | | | | | | | | | | | | |
| Southwestern Public Serv Co | Clovis, N. M | Clovis | | | | | | | | | | | | | | | | |
| **400 TO 599 PSI** | | | | | | | | | | | | | | | | | | |
| Iowa-Illinois Gas & Elec Co | Fort Dodge, Iowa | Fort Dodge | H A Kleinman | | 500 | 740 | 1 | 60 | BW | 1.72 | 7.29 | | | | DB | | | |
| Central Ohio Light & Power Co | Bluffton, Ohio | Woodcock | Sargent & Lundy | 2-42 | 490 | 825 | 1 | 90 | RS | 3.13 | 10.76 | 5.4 | 23.77 | | DB | | | |
| Nappanee Utilities Co | Nappanee, Ind | Nappanee | Laramore & Douglass | 10-46 | 450 | 700 | 2 | 25 | RS | 0.66 | 3.29 | 1.2 | 29.2 | | | | | |
| Northern States Power Co | La Crosse, Wis | French Island | | 3-47 | 450 | 750 | 1 | 150 | EM | 2.20 | 12.7 | | | | | | | |
| Iowa Public Service Co | Waterloo, Iowa | Maynard | J F Pritchard | 1-47 | 450 | 825 | 1 | 120 | | | | | | | | | | |
| Fort Bend Utilities Co | Sugar Land, Texas | | A H Weth | | | | | | | | | | | | | | | |
| Southwestern Public Serv Co | Roswell, N. M | Roswell | | | | | | | | | | | | | | | | |
| Minnesota Power & Light Co | Duluth, Minn | Duluth | Ebasco Services | | | | | | | | | | | | | | | |
| Southwestern Public Serv Co | Guymon, Okla | Guymon | | | | | | | | | | | | | | | | |
| Long Island Lighting Co | Glenwood Landing, N.Y. | Glenwood No. 2 | Burns & Roe | | | | | | | | | | | | | | | |
| Long Island Lighting Co | Glenwood Landing, N.Y. | Glenwood No. 2 | Ebasco Services | | | | | | | | | | | | | | | |
| Lynn Gas & Electric Co | Lynn, Mass | | Stone & Webster | | | | | | | | | | | | | | | |
| Missouri Utilities Co | Poplar Bluff, Mo | Poplar Bluff | Black & Veatch | | | | | | | | | | | | | | | |
| Southwestern Public Serv Co | Denver City, Texas | Denver City | Gibbs & Hill | | | | | | | | | | | | | | | |
| **BELOW 400 PSI** | | | | | | | | | | | | | | | | | | |
| Central Power & Light Co | Corpus Christi, Texas | Nueces Bay | Sargent & Lundy | | | | | | | | | | | | | | | |
| Southwestern Public Serv Co | Amarillo, Texas | East | | | | | | | | | | | | | | | | |
| Public Serv Co of Okla | Hugo, Okla | Hugo | | | | | | | | | | | | | | | | |
| Southwestern Gas & Elec Co | Texarkana, Ark | Texarkana | | | | | | | | | | | | | | | | |
| Mount Carmel Pub Ut & Serv Co | Mt Carmel, Ill | Mt Carmel | | | | | | | | | | | | | | | | |
| **CANADA** | | | | | | | | | | | | | | | | | | |
| New Brunswick Elec Power Comm | Chatham, N. B | Chatham | | | | | | | | | | | | | | | | |
| Nova Scotia Light & Power Co | Halifax, N. S | Halifax | Montreal Engrg Co | | | | | | | | | | | | | | | |
| New Brunswick Power Co | St John, N. B | Dock St | Montreal Engrg Co | | | | | | | | | | | | | | | |
| Maritime Electric Co Lmtd | Charlottetown, P. E. I. | Sydney St | Montreal Engrg Co | | | | | | | | | | | | | | | |
| Saskatchewan Power Comm | Saskatoon, Sas | Saskatoon | | | | | | | | | | | | | | | | |
| Saskatchewan Power Comm | Estevan, Sas | Estevan | H A Hanright | | | | | | | | | | | | | | | |

A —Air cooled
AA —Aeronautical Admiralty
Al —Aluminum bronze
Alr —Aluminum brass
ACF —Allis-Chalmers Mfg Co
Ac —Aeronautical copper
Ad —Admiralty
B&W —Babcock & Wilcox Co
B&W-G —Babcock-Wilcox & Goldie-McCulloch Ltd
C —Cast
CA —Cast aluminum
CB —Cast bronze
CF —C & F Furnace Ltd
D —Dual drive
Da —Damper
DB —Dry bottom
Dp —Duplex
EC —Erie City Iron Works
El —Elliott Co
FW —Foster Wheeler
G —Gas
GE —General Electric
H —Hydrogen
HB —Hardy
HF —Hagan
Hr —Hydrex
L —Lamella
M —Motor
P —Plate
R —Regulator



LIST PUBLISHED IN POWER, JUNE 1946

# 83.6%

# OF THE SOOT BLOWERS FOR THESE PLANTS ARE DIAMOND SOOT BLOWERS

Significant to the engineer concerned with soot blowers is the overwhelming preference for Diamond Soot Blowers in the representative central stations listed here. The 83.6% includes all types of Diamond soot blower installations . . . from automatic sequential air (and/or steam) soot blower systems to manually operated individual blowers . . . depending upon the needs and preferences of the particular plant.

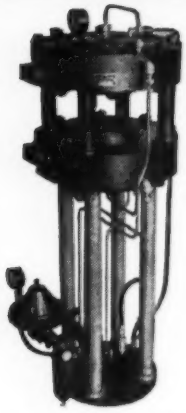
DIAMOND Model IK Long Retracting Soot Blowers

DIAMOND Telescopic Long Retracting Soot Blowers

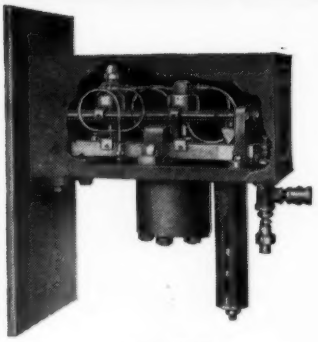
**DIAMOND POWER SPECIALTY CORP.,** DETROIT 31, MICH.

DIAMOND SPECIALTY LTD., WINDSOR, ONT.

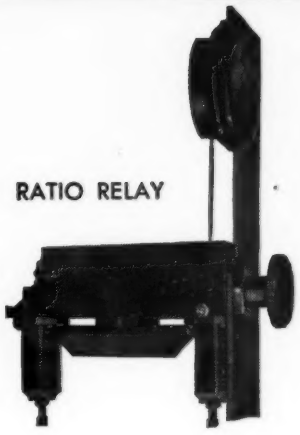
STEAM SEPARATOR



HAGAN THRUSTORQ

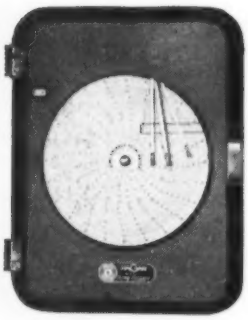


TYPE "F"
MASTER SENDER



RATIO RELAY

RING BALANCE
FLOW METER
(Indicating, Integrating
& Recording)



RING BALANCE
FLOW METER
(Integrating & Recording)

# *Typical applications for*

*This partial list, and accompanying photographs are published to remind you that Hagan service is broader than the automatic combustion control systems which are usually associated with the Hagan name.*

Control of combustion rate of boilers

Constant or graduated draft control

Constant or graduated pressure control

Feeder or stoker speed control

Control of multiple fuel firing

Fan speed control

Pump speed control

Hydraulic coupling control from speed or delivery of driven unit

Constant differential pressure control (liquids or gases)

Accurate control of position from remote point

Control of steam, gas, and liquid pressures

Measurement of steam, gas and liquid pressures

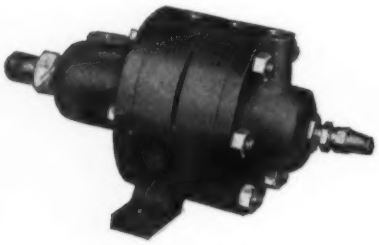
Control of pump discharge pressure and flow

Steam flow control

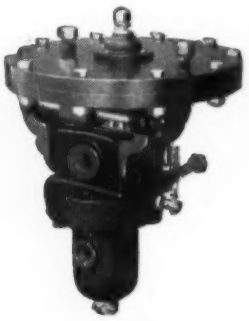
Steam pressure reduction and desuperheating control

Steam temperature control (superheat)

Removal of oil, moisture and solids from exhaust steam

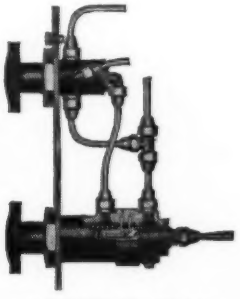


TYPE "F"
TOTALIZER

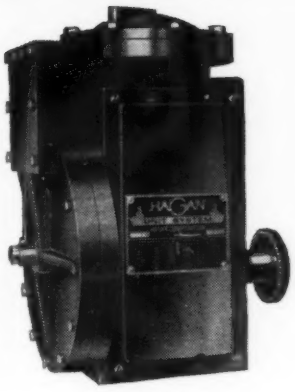


DIFFERENTIAL
TRANSFORMER

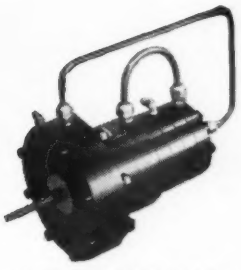
V PORT
BUTTERFLY
VALVE



COMPENSATING
RELAY

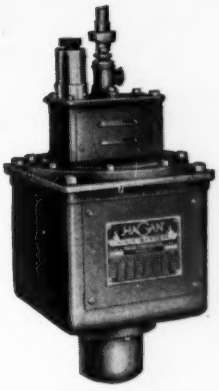


VARIABLE
RATIO REGULATOR



MICRO-POSITIONER

RECEIVING
REGULATOR



DIAPHRAGM
REGULATOR

# HAGAN *equipment*

Removal of oil and moisture from compressed air

Control of separately fired superheaters

Flow control (liquids and gases)

Flow measurement of liquids and gases with pressure and temperature compensation

Gas mixing control

Fuel-air ratio control

High temperature regulation

Remote manual or automatic control

Recovery of steam from continuous blowdown systems

Program control

Oil burner control

By-pass damper control for air preheaters

Feed water heater pressure and temperature control

Liquid level control

Control of multi-speed motor drives

Safety protection for gas or pulverized coal firing

Steam jet refrigeration control

Force measurement and control

Measurement and control of thrust and torque

*We will be glad to supply full information concerning any of these applications or pieces of equipment.*

*Hagan Corporation, Hagan Building, Pittsburgh* 30, *Pa.*

THERMOSTAT

HAGAN
HALL
BUROMIN
CALGON

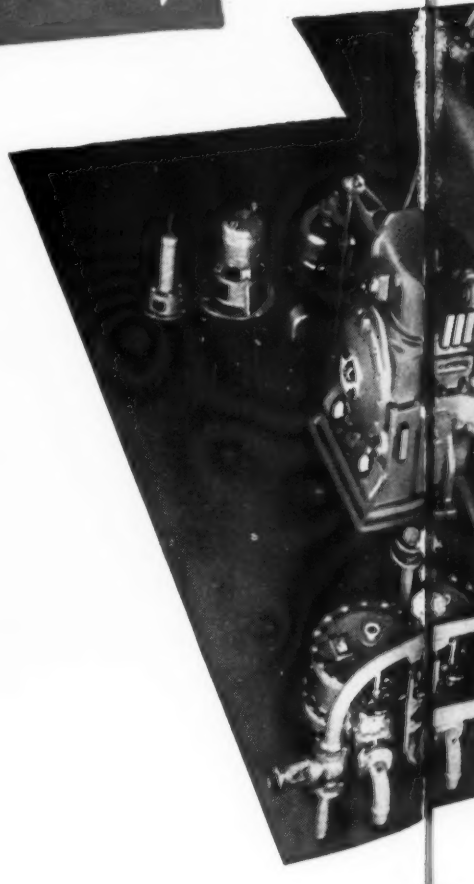
## HAGAN CORPORATION

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

A simple machine like this needs no special lubrication . . . but oils for modern turbines must be inhibited against rust and oxidation and processed to prevent foaming. Operators everywhere assure this protection by using Texaco Regal Oils (R & O).

# (R&O) WOULD BE WASTED HERE . . .

# (R&O) IS



WHAT'S (R & O)? It's the designation now added to the world-famous name . . . Texaco Regal Oils . . . to denote the addition of special inhibitors against rust and oxidation. It's your assurance that *Texaco Regal Oils* (*R & O*) will keep your lubricating systems clean.

*Texaco Regal Oils* (*R & O*) free themselves rapidly of air and water . . . prevent sludge and rust formations . . . and do not foam. They keep bearing temperatures normal, assure smooth and instant response from your governors. In addition, they have extra long service life.

*Texaco Regal Oils* (*R & O*) meet the turbine oil specifications of all leading turbine manufacturers, as well as those of the United States Navy.

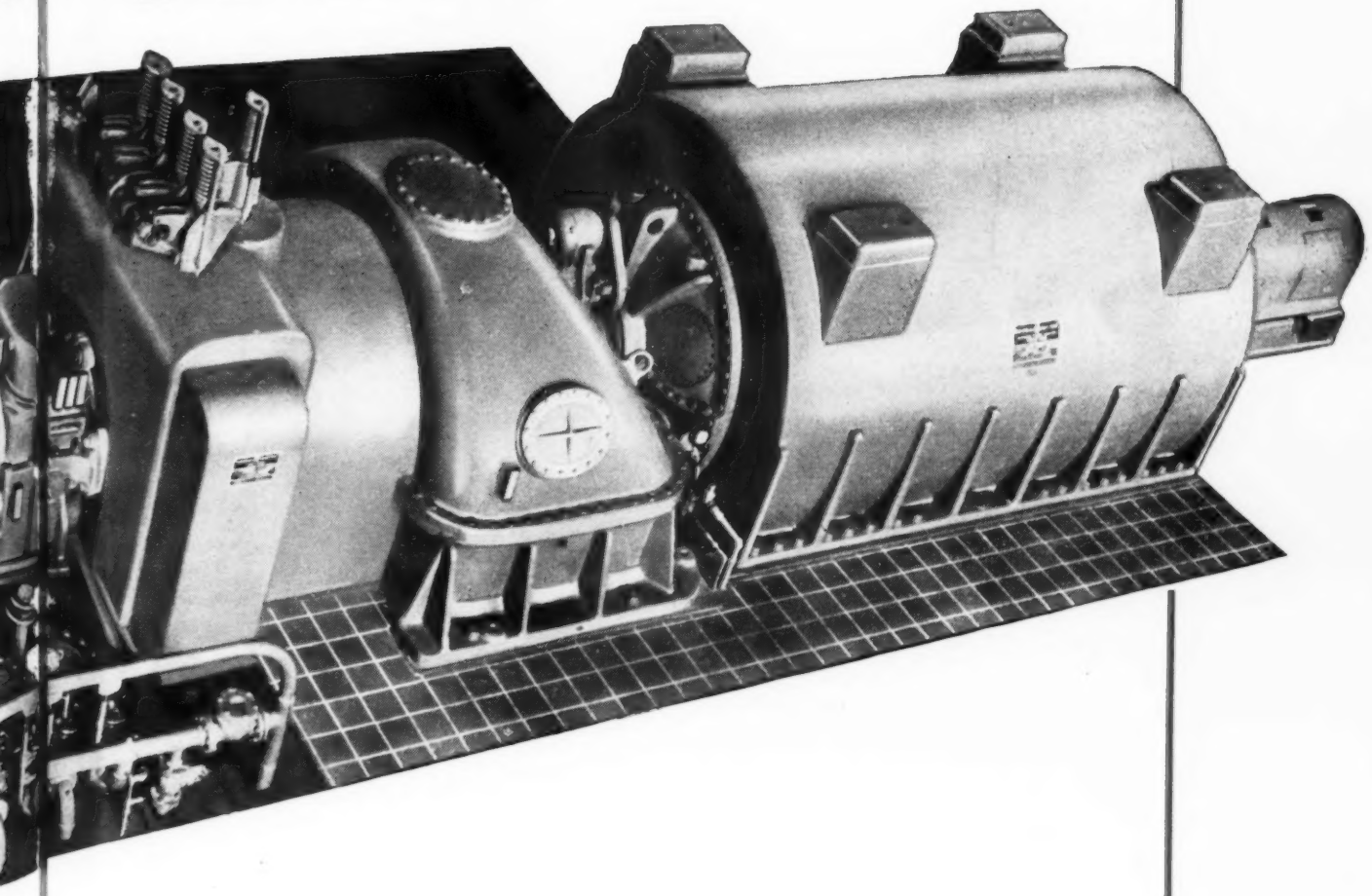
Texaco Lubrication Engineering Service will gladly tell you more about *Regal Oils* (*R&O*) and other Texaco lubricants for power plants. Just call the nearest of the more than 2500 Texaco distributing plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, New York.

Tune in . . .
TEXACO STAR THEATRE
presents the NEW
TONY MARTIN SHOW
every Sunday night.
See newspaper for
time and station.

TEXACO

# S VITAL HERE



## REGAL OILS (R & O)

FOR ALL TURBINES

# Lower Production Costs May

BAILEY METERS

## An Invitation

There is a quick, easy way to convince yourself that co-ordinated boiler control will be profitable to you. Ask a Bailey Engineer to arrange a visit to a nearby Bailey Installation. We invite your inspection.

This installation of Bailey Boiler Control on five boilers fired by spreader type stokers insures fuel economy, safety of operation, and continuity of service. These 150 psi, 60,000 lb per hr capacity boilers supply steam for heating the various buildings of a large institution.

If your steam generating units have individual capacities of 10,000 lb per hr. or more, it may be profitable for you to use a Bailey co-ordinated boiler control system.

# Begin at Your Boiler

LOOKING for ways to cut production costs? Then it may pay you to look in your boiler room. Check to be sure you are getting co-ordinated boiler control. This is the one method that assures maximum returns from your fuel dollars.

The Bailey co-ordinated boiler control system effectively reduces fuel consumption per pound of steam generated. It increases safety of operation and improves continuity of service. Combustion, feed water, steam temperature, heater levels, pump speeds and all other factors are co-ordinated to deliver top boiler performance.

And most important to you—every Bailey Control System is engineered to the specific job on which it is to be used. Take *your* application, for example. To determine how Bailey Controls can improve your boiler performance—

## *Call This Man*

He is a Bailey Engineer. Back of him are years of experience in engineering control systems for fuel burning equipment of all types. He will work directly with you and your engineers in the design and application of the meters and controls required by your installation.

This engineering service is yours for the asking . . . available in more than 30 industrial areas throughout the United States and Canada.

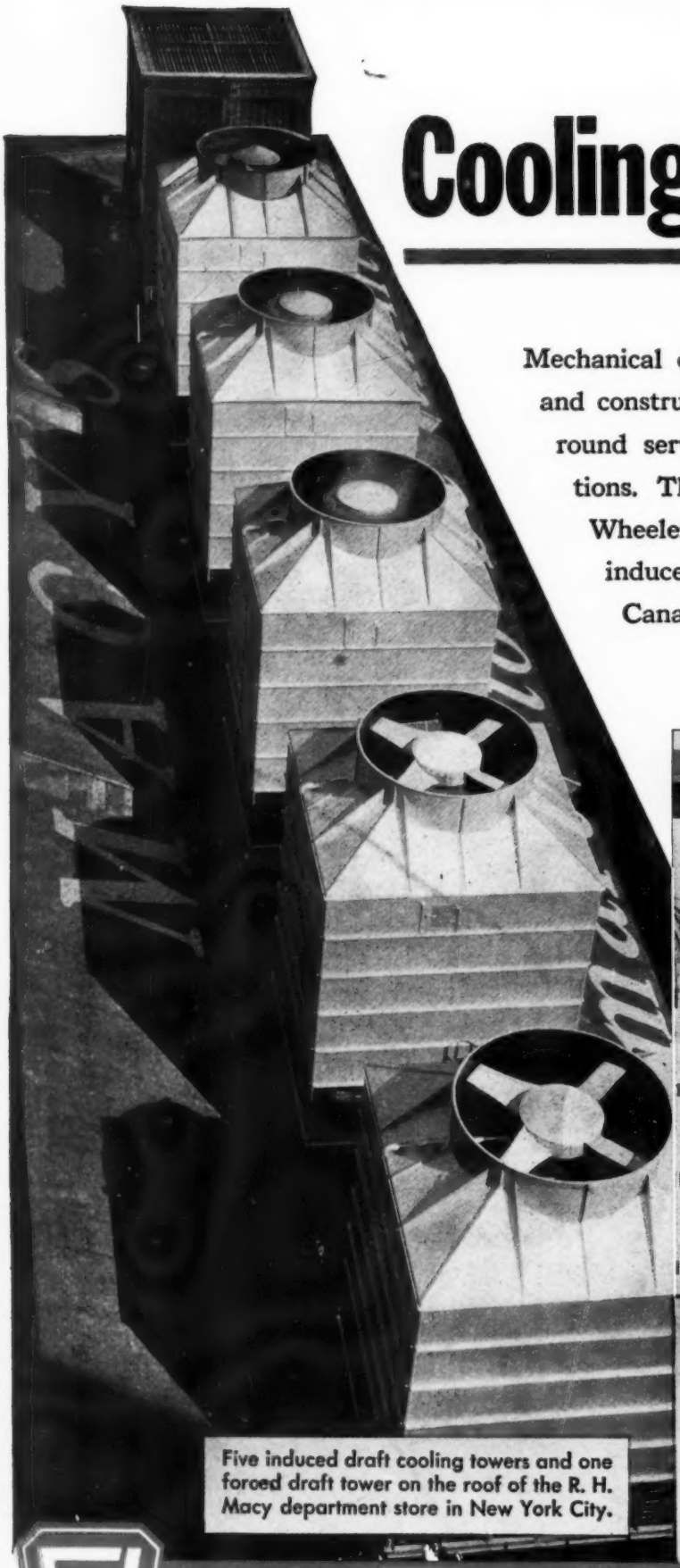
**BAILEY METER COMPANY**
1036 IVANHOE ROAD
CLEVELAND 10, OHIO

*Controls* FOR STEAM PLANTS
COMBUSTION • FEED WATER • TEMPERATURE
PRESSURE • LIQUID LEVEL • FEED PUMPS

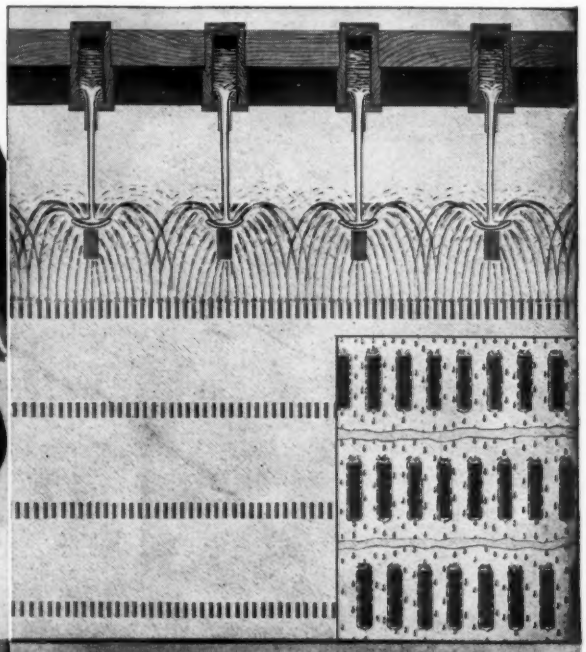
A-100-2

# Cooling Towers and

Mechanical draft cooling towers, properly designed and constructed, will deliver full capacity in year-round service irrespective of atmospheric conditions. The wide experience gained by Foster Wheeler engineers in developing forced and induced draft cooling towers now serving from Canada to India insures highest performance.



Five induced draft cooling towers and one forced draft tower on the roof of the R. H. Macy department store in New York City.



**WATER DISTRIBUTION and TOWER FILLING**

The modern system of water distribution is from troughs, the water falling through nozzles upon splash plates. These plates throw an even spray of drops over the whole area of the tower. The drops then fall upon wood slat filling, which presents a large wetted surface and retards their fall to effect extreme air-water contact in the counter-current air flow.

FW FOSTER

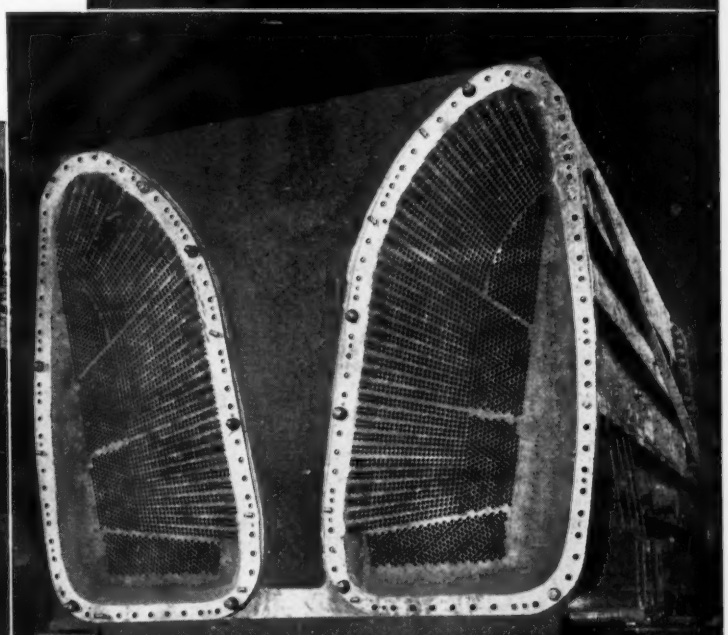
# Condensing Equipment

Condensers built by Foster Wheeler have evolved from those built by pioneer manufacturers in the United States. They serve today in some of the most efficient utility and power plants in the country. Foster Wheeler also manufactures a complete line of highly developed auxiliaries to assure top efficiency. Auxiliaries include steam jet vacuum pumps, condensate pumps and circulating pumps of centrifugal and axial flow design.

**FOSTER WHEELER CORPORATION**
**165 Broadway, New York 6, New York**

Shop assembly picture of a 34,500 sq. ft. single pass, cross flow type condenser, showing internal baffles, tube support plates and structural members.

Drilling tube sheets in the Carteret shops. Two sheets are drilled at the same time.



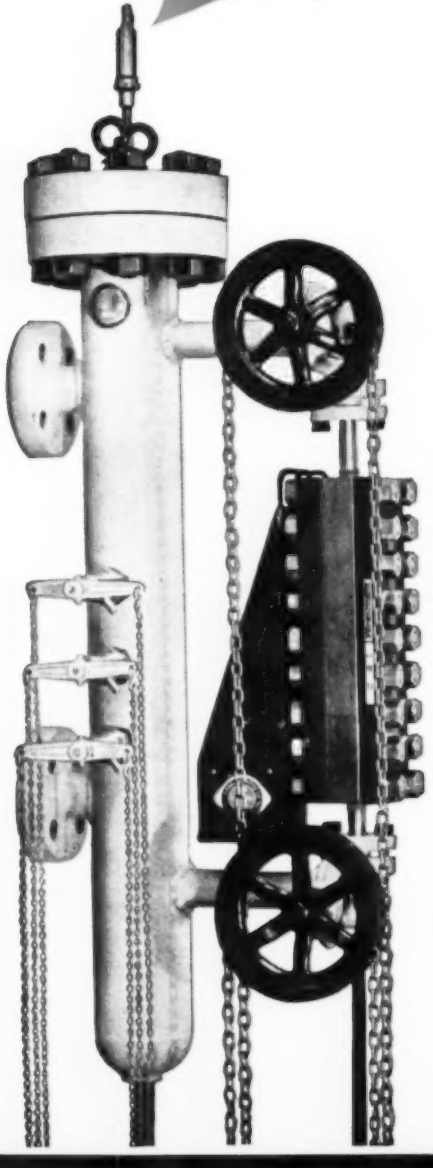
The same condenser with tube sheets in place. Arrangement of tubes indicates the short steam lanes used in each tube bank of a low headroom design.

WHEELER

# One

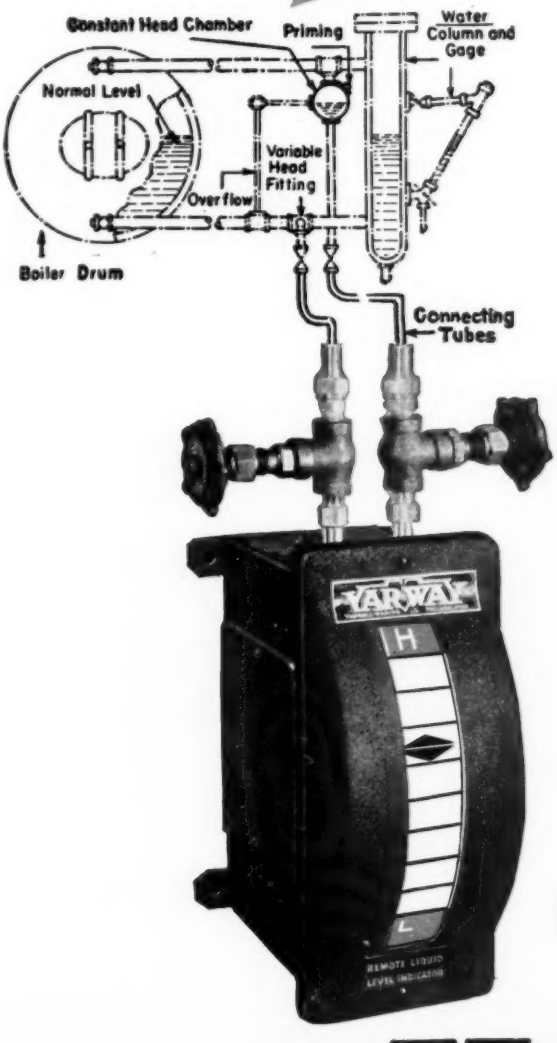
## WHEN YOU BUY

**YARWAY WATER COLUMNS AND GAGES**



A

**YARWAY REMOTE BOILER WATER LEVEL INDICATORS**



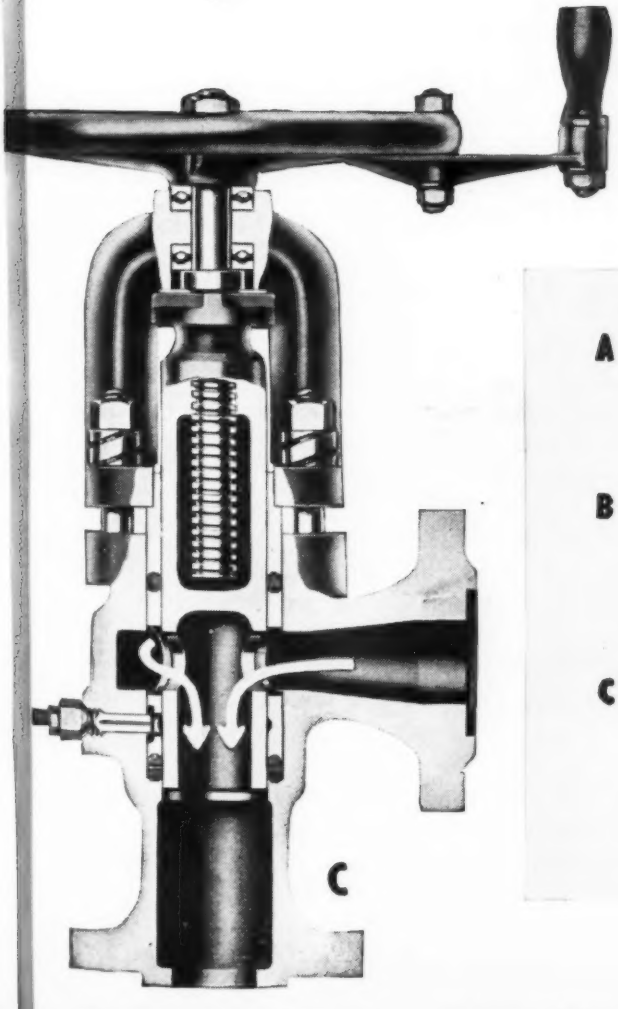

B

YARWAY

# RESPONSIBILITY

## all 3 FROM YARWAY

**YARWAY BLOW-OFF VALVES**




Power plant engineers may simplify responsibility by insisting that all three of these important boiler trim items be Yarway.

Why, you ask?

First, responsibility for the satisfactory performance of all three is centered in one company.

Second, Yarway's extensive service organization, with branches in principal cities in the United States and Canada, is conveniently at your service.

Third, each product has an outstanding feature—an *engineering reason,* laboratory-tested and field-proved for better performance.

For more complete facts on these and other products in the Yarway line of steam plant equipment, write for Yarway's all-products Catalog G-1306.

**YARNALL-WARING COMPANY**
**100 Mermaid Ave., Philadelphia 18, Pa.**

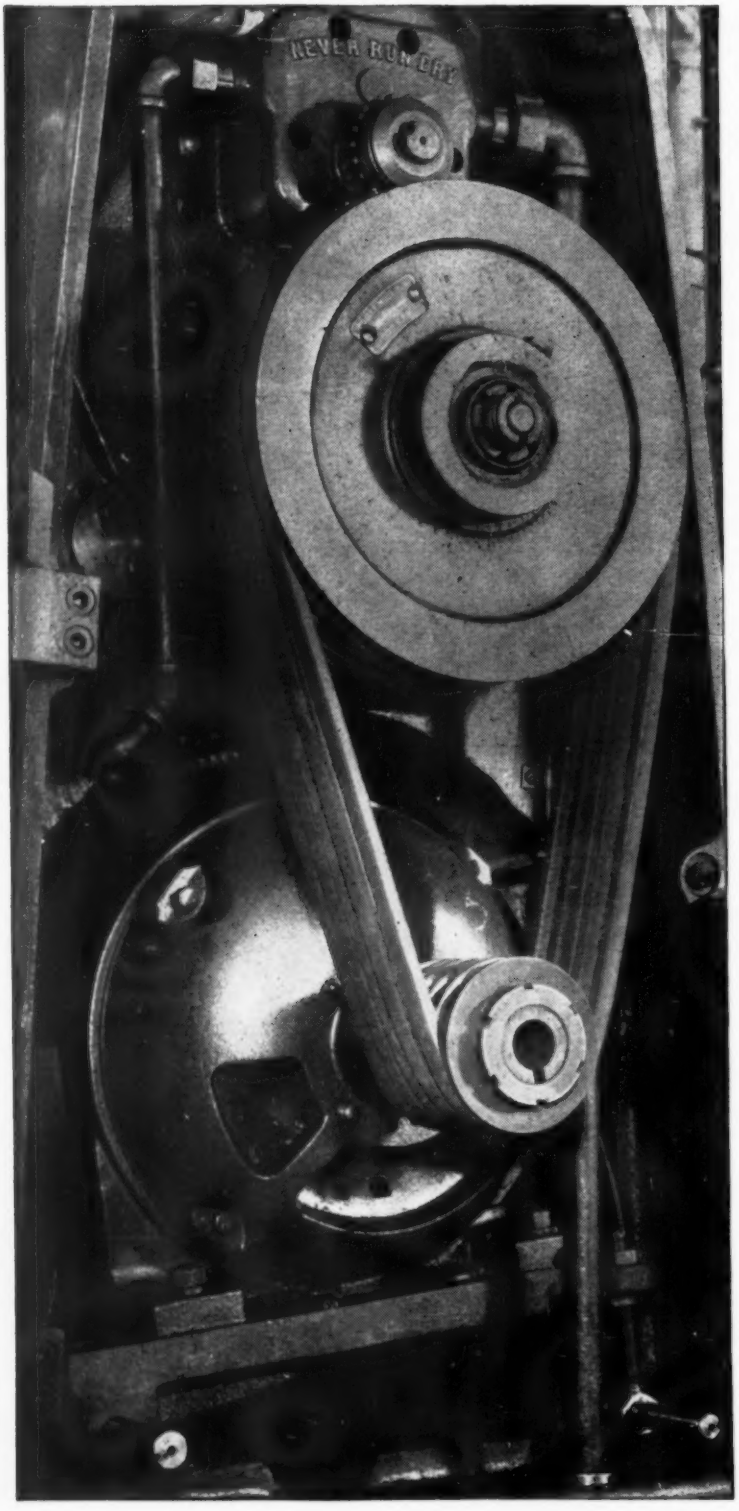
**A —** Yarway Hi-Lo Alarm *Floatless* Water Column with patented Yarway Flat Glass Gage featuring a "floating assembly" that practically eliminates glass breakage. For pressures from 400 to 2500 psi. Other Yarway Columns and Gages for lower pressures. Write for Yarway Bulletin WG-1810.

**B —** Yarway Remote Boiler Water Level Indicator that brings overhead readings right down to eye level, on instrument panel or other convenient place. Always accurate because it's operated by the boiler water itself. Action is instant, constant. No *stuffing boxes.* Moderate in price. Easy to install. For all pressures to 1500 psi. Write for Yarway Bulletin WG-1821.

**C —** Yarway Seatless Blow-Off Valve. No seat to score, wear and clog with mud, scale and dirt. Balanced sliding nitralloy plunger simplifies operation. Also furnished in Tandem, or as a Unit Tandem combined with a Yarway Hard-Seat Valve for highest pressures. Write for Yarway Bulletin B-424 for pressures to 400 psi; Bulletin B-432 for pressures to 2500 psi.

# STEAM PLANT EQUIPMENT

# 5 BILLION




## FIVE YEARS IN "SOLITARY"!

Many machine tools in the Bell Aircraft plant at Buffalo have pioneer Tri-Clad motors tucked away inside. The result is a sleek exterior for the machine and valuable floor space saved. During the war, when time was short and uninterrupted production was of utmost importance, these motors gave dependable service, demanding only a minimum of lubrication and inspection.

The Tri-Clad motor you see here driving a milling machine has not been removed for five years. Operating in confined quarters, where the volume of cooling air was limited (and laden with oil), it has done its job faithfully, despite the strain of a 3-shift, 7-day work schedule. Thanks to the extra protection built into this and the more than 200 other Tri-Clad motors in the Bell plant, they give every sign of staying on the job indefinitely.

## *Now*— MOTOR TOUGHNESS AT ITS PEAK

Newest addition to the Tri-Clad motor family is the Tri-Clad totally enclosed, fan-cooled motor. It is designed for use in adverse atmospheres — in iron dust, out-of-doors, in hazardous areas, and chemical atmospheres. Available in both standard and explosion-proof types, this motor gives you these important construction features:

- **A cast-iron, double-wall frame which completely encloses and protects the windings and punchings.**
- **A nonshrinking compound around motor leads which protects motor interior from dust and moisture.**
- **A rotating labyrinth seal which further protects the motor interior from damage by foreign matter.**

# MOTOR HOURS

## PROVE YOU CAN'T BEAT

## TRI/CLAD

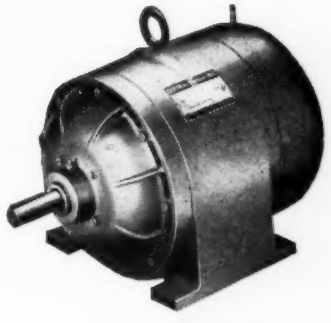
# EXTRA PROTECTION

Since 1941, nearly a million Tri-Clad motors have been purchased by American industry.

Figured conservatively, they have delivered more than 5 billion hours of service — most of this service under war-time conditions when maintenance was infrequent and overloads were the rule.

This Tri-Clad motor record for continuous service under adverse conditions is the best proof we can give you that these motors have *even better protection* than we promised.

Remember, the Tri-Clad motor family now includes dripproof, totally enclosed, vertical, gear, and capacitor-motors. All of these types, we believe, offer you a combination of performance characteristics, horsepower-per-frame-size, and protective features that no other line of general-purpose motors can match. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



**EXTRA PROTECTION . . . AGAINST PHYSICAL DAMAGE!**

Rigid cast-iron frame and end shields protect vital motor parts from external abuse and also prevent resonance. Because they're not at the mercy of a coat of paint, they strongly resist chemical attack and dampness. Cast iron also gives you tight, *metal-to-metal* fits between end shields and frame.

**EXTRA PROTECTION . . . AGAINST ELECTRICAL BREAKDOWN!**

Motor windings of Formex* wire, together with improved insulating materials, reduce the chances of electrical failure. Heat is dissipated quickly — motor stays young for years and years!

**EXTRA PROTECTION . . . AGAINST OPERATING WEAR AND TEAR!**

Bearing design affords longer life, greater capacity, improved lubrication features. Bearing seals retain lubricant, keep out dirt. One-piece, cast-aluminum rotor is practically indestructible.

*Trade-mark reg. U. S. Pat. Off.

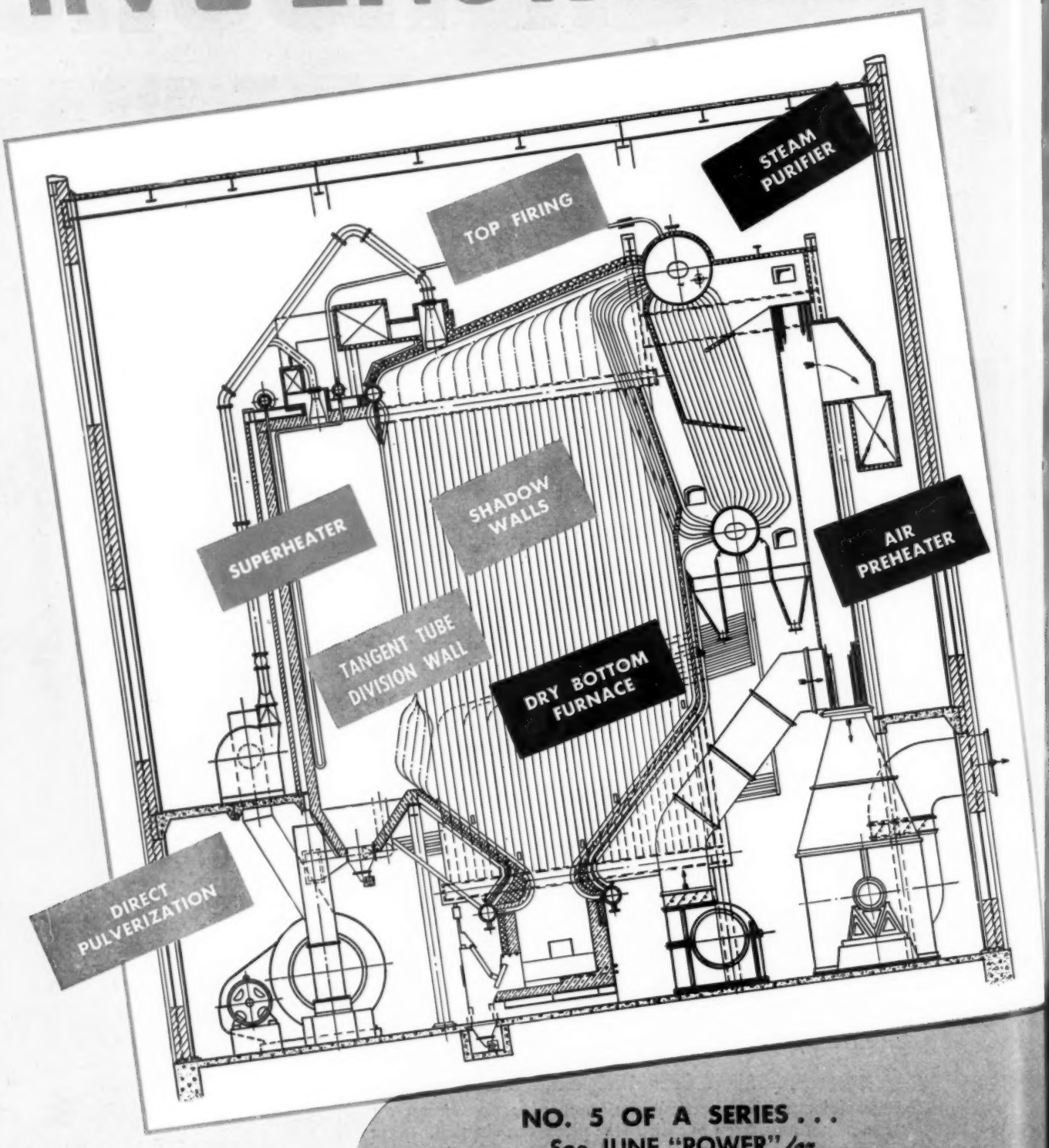
**GENERAL ELECTRIC**

750—296

TRI/CLAD
REG. U.S PAT OFF
MOTORS

- OPEN (DRIPPROOF)
- TOTALLY ENCLOSED
- EXPLOSION-PROOF

# KVS ENGINEERED




**NO. 5 OF A SERIES . . .**
See JUNE "POWER" *for description of* TANGENT TUBE REAR FURNACE WALL

# SUPERHEATERS

## *assure*

## *uniformly controlled steam temperatures at all ratings*

The control of final superheat temperature is effected by one of two methods:

FIRST: Direct, separately fired, thermostatically controlled superheater providing high transfer rate by radiation.

SECOND: Convection superheater situated in the first gas pass and thermostatically controlled by pass damper.

A combination of convection superheater section to carry extremely low loads and a direct, separately fired, thermostatically controlled radiant booster superheater unit to augment output at high ratings insures temperature control that will meet all conditions.

KVS Engineered Superheaters utilize either one of the above systems of superheating and superheat control, to meet the individual requirements of any specific job.

KVS Superheaters, along with all other components of KVS Steam Generating Units are engineered to meet specific operating conditions on available fuels in order to assure the maximum in operating efficiency and economy at all boiler ratings.

KVS ENGINEERING SERVICE

KVS Steam Generating Equipment has been performance proved over the years. KVS offers a complete service in design, building and erecting complete plants under one responsibility. KVS engineers are available for consultation on your requirements.

Ask for a copy of 97-page Engineering Bulletin No. 44-B containing valuable information on preparation of pulverized fuel and steam generating plants.

KENNEDY-VAN SAUN · QUALITY · SERVICE · Kennedy Products · NEW YORK USA · MFG. & ENG. CORP.

**Kennedy-Van Saun**

MANUFACTURING AND ENGINEERING CORPORATION

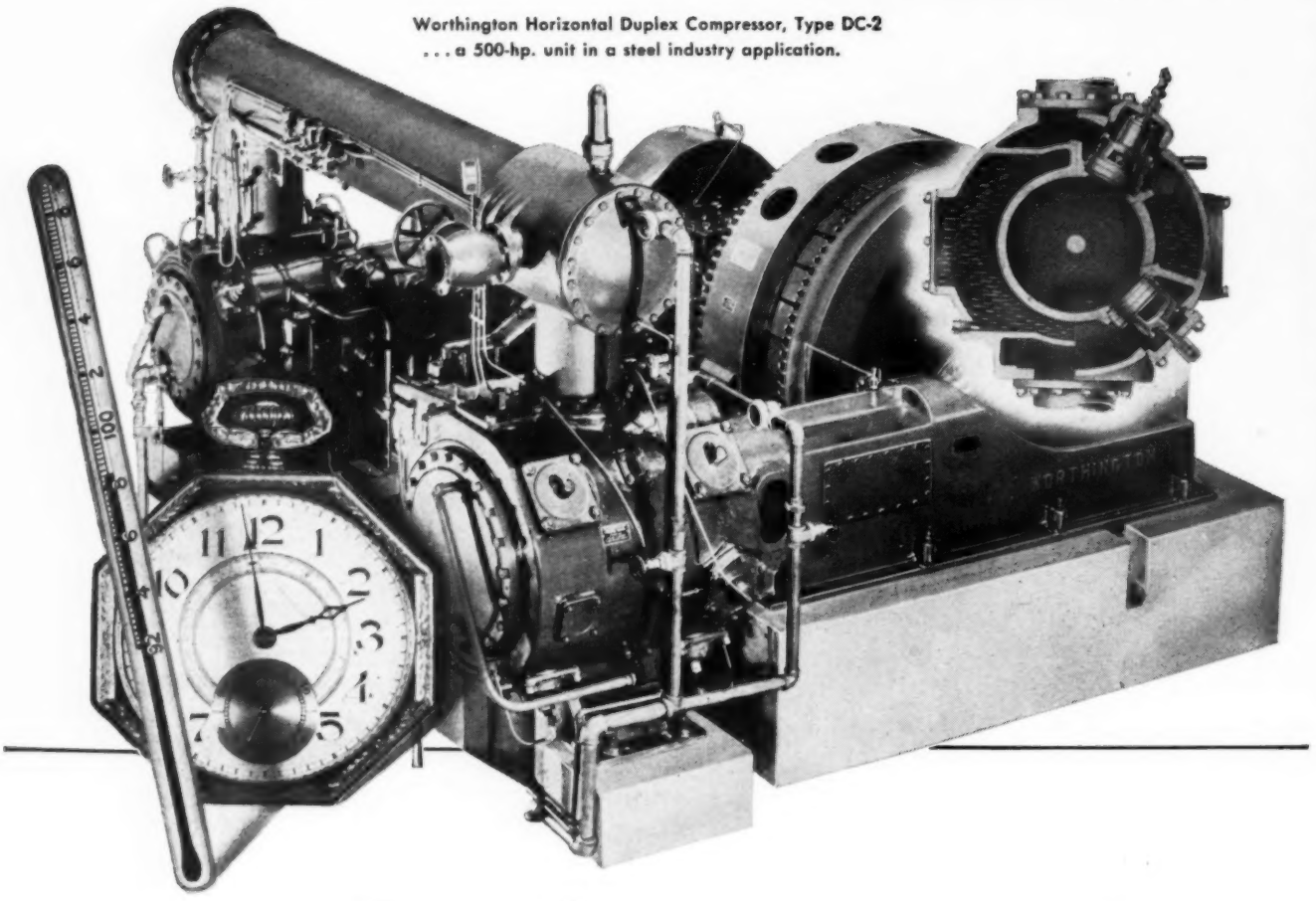
ARMY E NAVY

2 PARK AVENUE • NEW YORK 16, N. Y.

FACTORIES: DANVILLE, PA.

CANADA • ENGLAND • FRANCE • AUSTRALIA

Worthington Horizontal Duplex Compressor, Type DC-2
. . . a 500-hp. unit in a steel industry application.



# PULSE: *Rapid* TEMPERATURE: *Low*

Typical of the way Worthington builds "top efficiency" into big compressors are the precautions taken to reduce temperature of the cylinders and valves of Worthington Type DC-2 units . . . a line of hard-workers from 75 to 3000 hp.

Water jacketing around the cylinder and in the heads keeps temperature . . . and, therefore, power consumption . . . at a minimum. Valve locations receive cooling from both cylinder and head jackets. The exclusive Worthington Feather* Valves — lightest, tightest, most efficient ever devised — reduce air or gas friction to a minimum.

**WRITE FOR BULLETIN L-675-B1A**

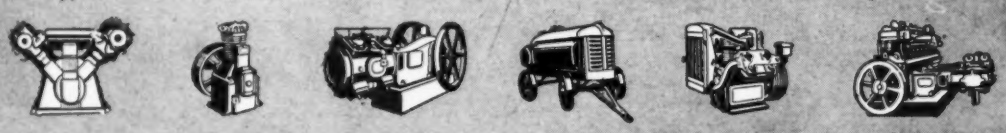
Write for your copy of this 32-page bulletin today and learn why—in compressors as in so much other equipment — *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, N. Y.*

*REG. U. S. PAT OFF. K7-6

**WORTHINGTON**

**NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON**

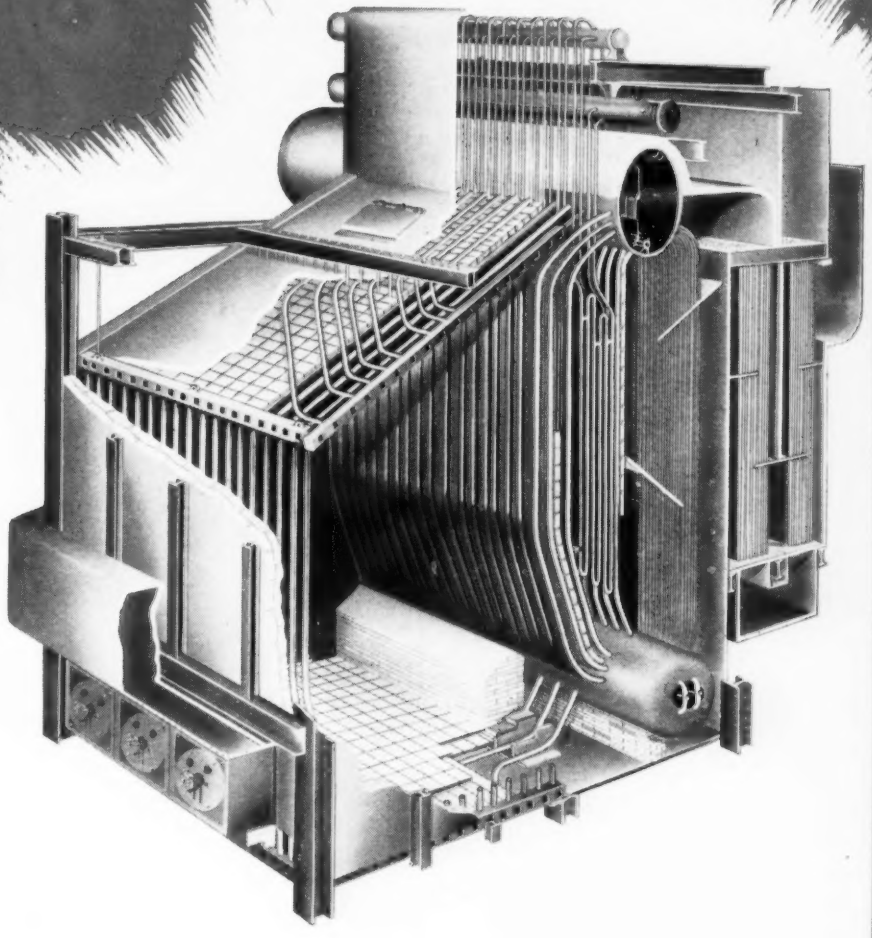
Y-types Vertical Horizontal Portable Radial Gas-Engine Compressors



# Designed and Built

FOR YOUR

"MODERN POWER PLANT"



- **RADIANT HEAT FURNACE.** Water cooled surface disposed to meet each particular operating condition. Minimum furnace maintenance required.
- **BALANCED DESIGN.** Heating surface in the Springfield design is proportioned to give dependable and predictable results. Eighty percent, or more, of the steam is produced by the furnace and first bank of 3" tubes. Gas flow is uniformly distributed across the width of the unit. Gas temperature entering the rear tube bank is maintained at a low level so that 2" tubes can be safely used, thus giving maximum efficiency in minimum space.
- **DRY STEAM.** Multiple stage steam separators effectively prevent possibility of carry-over and insure dry steam at all operating rates.
- **SUPERHEATER.** Interbank type, designed to give minimum variation in steam temperature over wide range. Easily serviced, readily accessible.
- **DRUMS.** Welded, X-rayed and stress-relieved to meet all specified code requirements.
- **AIR PREHEATER.** Clean cut, easy to maintain and simple in arrangement.
- **FIRING.** Firing may be by coal, oil or gas.
- **SIZES.** Offered in capacities from 20,000 lbs. up and for pressures up to 900 p.s.i.

*IT'S WORTH LOOKING INTO!*—this modern steam generator. Built by Springfield to Springfield's standards for QUALITY. Look at the rugged, generously proportioned construction. There is no skimping here! Close spaced waterwalls . . . completely water-cooled furnace . . . large combustion volume . . . electric cast steel headers . . . air preheater (or economizer) . . . all in a compact unit, insuring long life, low maintenance, big overload capacity, and high efficiency over a wide load range.

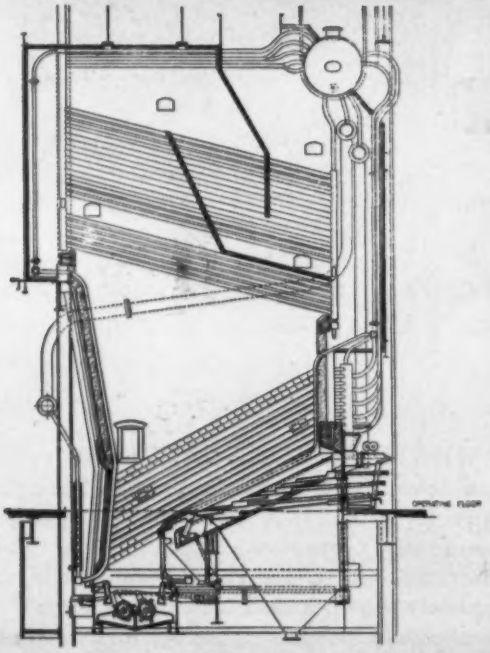
*Depend on Springfield for GOOD Boilers!*

**SPRINGFIELD BOILER CO.**

**1953 E. Capitol Ave., Springfield, Illinois**

*by Springfield*

SPRINGFIELD BOILERS



A typical 1947 installation of Taylor Stoker (Type R—capacity 240,000 lb./hr.) in a large U. S. Govt. heating plant.

The Taylor Stoker isn't "finicky" about what it consumes—its fuel-flexibility permits the use of a variety of types and sizes of coal, whatever is convenient for YOU from the standpoint of price, labor, delivery, mine location and any other cost lowering considerations you may have.

Cut combustion costs the Taylor Stoker Way. It's the fuel-flexible economy stoker.

## WATCH THE TREND!

Throughout industry wherever underfeed stokers are discussed Taylor is first mentioned —the buyer's choice on original and repeat installations. That means *proved* performance.

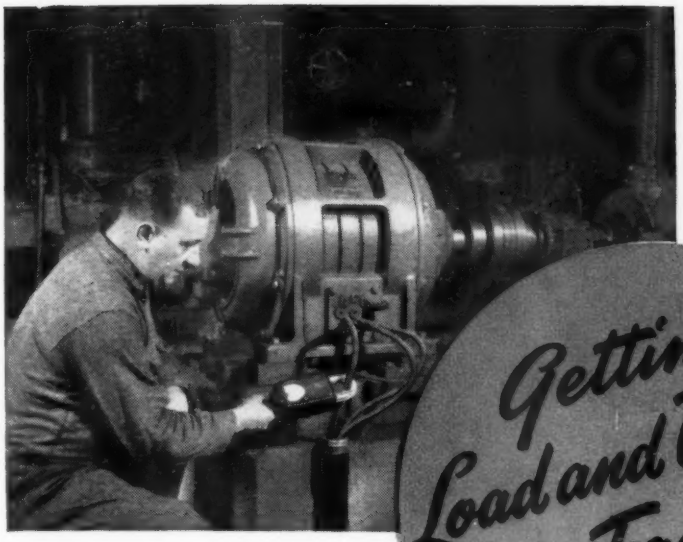
UP-TO-DATE FACTS ON THIS IMPROVED TAYLOR STOKER

If you aren't up to the minute on Stokers, get your copy of this booklet. Write to Department 24 today!

# TAYLOR STOKER

**AMERICAN ENGINEERING COMPANY**

2400 ARAMINGO AVENUE, PHILADELPHIA 25, PA.



*Getting Load and Voltage Facts IN A HURRY!*

# TYPE AK-1 HOOK-ON VOLT-AMMETER

To keep plant operation at peak efficiency and spot trouble before it causes costly breakdowns, constant testing with reliable instruments is a "must." Here you'll find the General Electric hook-on volt-ammeter one of the handiest and most versatile instruments you've ever used, for it permits quick measurement of both volts and amps.

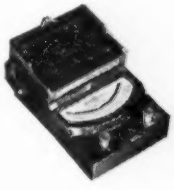
## 6 INSTRUMENTS IN ONE

The reason the AK-1 hook-on volt-ammeter is so handy is that it's really six instruments in one. It has six ranges: 0-15/60/150/600 amp and 0-150/600 volts (for a-c circuits only). To measure amperes, all you do is hook it around a conductor, flick the selector switch to AMPERES, and there's your measurement—no cutting of conductors, no lost service. To measure volts, all you do is connect the voltage leads, snap the switch to VOLTS, and take the reading—no extra equipment needed.

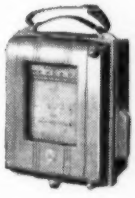
Extension poles, in four- and six-foot lengths, are available for using the AK-1 on high-voltage circuits, and for reaching into inaccessible places. Also, a cowhide leather carrying case can be obtained for protecting the instrument when it is not in use. For further information, contact your local distributor or your nearest G-E sales office. Write for Bulletin GEA-2950, *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

*Which of these Testing Instruments do you lack?*

AF-1
A-C LOAD
VISUALIZER



AP-9
A-C VOLT-
METERS and
AMMETERS



CF INKLESS
RECORDER

GAUSS
METER

GENERAL ELECTRIC

6G2-111

Fig. 1430
Iron Body Gate

Fig. 1938
Steel Gate

# YOU CAN'T BEAT this VALVE SERVICE

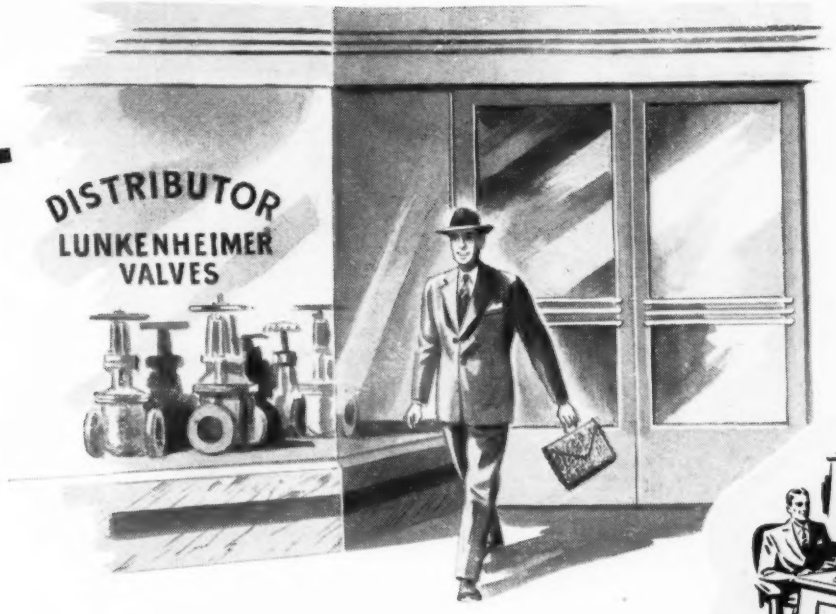
**PHONE YOUR LUNKENHEIMER DISTRIBUTOR**

Whether it's an emergency call, routine repair and maintenance service, or a new installation to make, phone your Lunkenheimer Distributor for fast, dependable service.

Fig. 16-P
"Renewo"
Globe

Fig. 2125
Bronze Gate

# LUNKENHEIMER VALVES




Speeded-up production has taken its toll of plant equipment. Break-downs and unexpected failures are more numerous.

A thorough check-up now will pay dividends. And don't overlook your steam, water, and air lines. A sudden valve failure might mean loss of valuable power and production.

Should valve trouble occur, you can get help . . . quickly . . . from your near-by Lunkenheimer Distributor. Long established in the community, he has thoroughly experienced personnel and adequate stocks . . . all the facilities and "know-how" for solving your valve problems.

*Engineering Service*

*Complete Stock Room Facilities*

*Aid in Solving Operating and Maintenance Problems*

*Direct Delivery Service*

ESTABLISHED 1862

**THE LUNKENHEIMER CO.**

"QUALITY"

**CINCINNATI 14, OHIO, U. S. A.**

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BOSTON 10 · PHILADELPHIA 34

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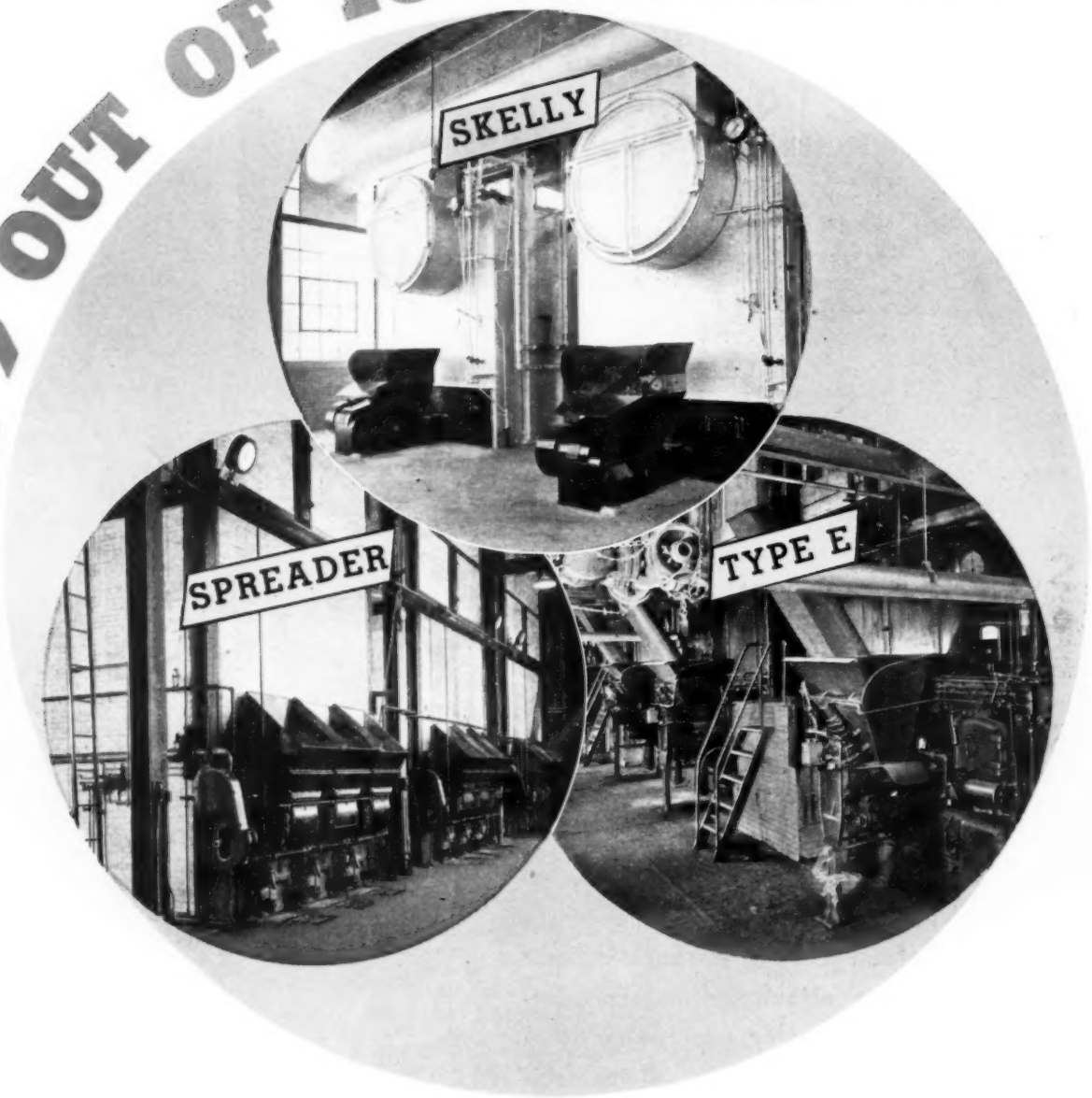
**BRONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES, 125 TO 2500 LB. S. P.:**

**BOILER MOUNTINGS, LUBRICATING DEVICES, AIRCRAFT FITTINGS**

# FOR 9 OUT OF 10 STOKER JOBS




SKELLY STOKER

The C-E Skelly Stoker is unquestionably the quality stoker in its field. Skelly Stokers are now serving industrial plants, office and apartment buildings, schools, churches, laundries and the like in every section of the country. They are available in designs for either bituminous coals or for anthracite. The Skelly's long record of success in burning a wide variety of bituminous coals has been matched in recent years by hundreds of anthracite installations.

SPREADER STOKER

The remarkable acceptance of the C-E Spreader Stoker is indicated by the fact that in the nine years it has been on the market C-E Spreaders have been purchased to serve boilers having an aggregate capacity of more than 17,000,000 lb of steam per hour. They are serving from Alaska to the southernmost part of Chile, in Australia, China, France, Russia, Spain, South Africa, Turkey and in 32 states in the U.S.A. from Maine to Oregon.

TYPE E STOKER

The Type E Stoker is one of the best known and most widely used in the world, serving substantially more boiler heating surface (over 14,500,000 sq ft in American plants alone) than any comparable stoker. It continues to be the choice of many leading companies in virtually every field of industry. Those who know it through experience continue to buy it as evidenced by the fact that over 35 per cent of all Type E contracts are repeat orders.

C·E

# COMBUSTION

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

# ONE OF THESE 3 C-E TYPES

## *is the best answer*

Single Retort Underfeed and Spreader Stokers are far and away the most widely used types these days, accounting for about 90 of every 100 stokers installed under boilers rated from 50 hp up.

The high percentage of C-E Stokers selected in this category is indicative of how well these three types, described here, blanket this field.

And for the remaining 10 percent, C-E also has the right answers in its modern designs of Multiple Retort, Traveling and Chain Grate Stokers,—all of them leaders in their respective fields.

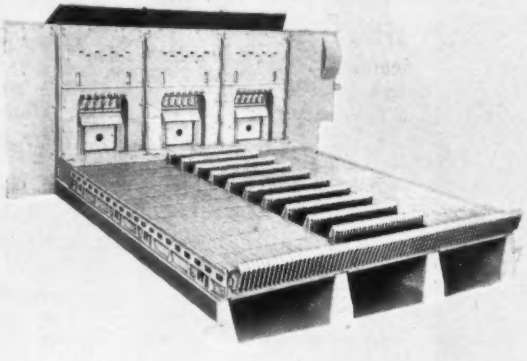
So whether your plant is one of the 90 percent group or one of the 10 percent, you can turn to C-E with complete confidence that you will get the right answer for your requirements. You will also have the satisfaction of knowing that your stoker reflects the experience accumulated in installing over 19,500 stokers of all types, above residence size, to serve more than 55,000,000 sq ft of boiler heating surface. This is Combustion Engineering's record to date and no other stoker manufacturer in the country can match it.

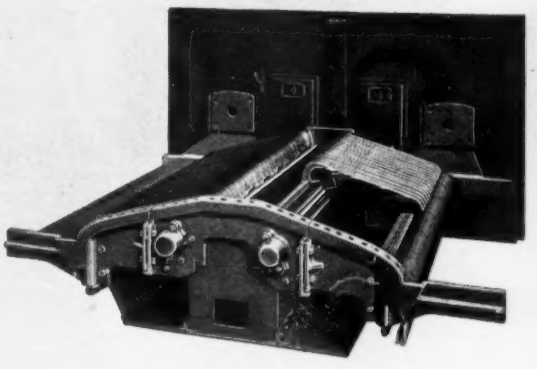
B-145

**SKELLY STOKER** (upper right) — Approximate Application Range — 20 to 200 boiler hp. A compact, self-contained unit offering all the advantages of underfeed firing. Moving grate bars assure lateral distribution of fuel and maintain a clean porous fire. Cantilever dump grates of non-avalanching type simplify ash removal. Integral forced-draft fan, with inlet control, permits positive regulation of air-coal ratio. Sixteen rates of coal feed through variable-speed transmission. Automatic control is standard equipment. Timken bearing equipped. Alemite lubrication throughout.

**TYPE E STOKER** (lower right) — Approximate Application Range — 150 to 600 boiler hp. A single-retort, underfeed stoker designed to burn a wide variety of bituminous coals. Ram feed is supplemented by a reciprocating sliding bottom. Grate surface consists of hollow, air-cooled grate bars, alternately fixed and moving, to condition the fuel bed and assure its steady movement toward the dump trays. Air supply under zoned control with provision for introducing air over the fire. Steam, electric or hydraulic drive.

**SPREADER STOKER** (lower left) — Approximate Application Range — 150 boiler hp to largest units suitable for stoker firing. A simple, rugged stoker designed to burn a wider variety of fuels than any other type of mechanical firing. Hopper, feeding and distributing mechanism, variable-speed drive and motor are combined in a compact unit. Rotating spreader blades feed coal into the furnace in crisscrossing streams which assure uniform distribution. Fines are burned in suspension and the rest of the coal is burned on a grate — either dumping or continuous discharge type. Grate surface is zoned for regulating air admission and to facilitate cleaning.

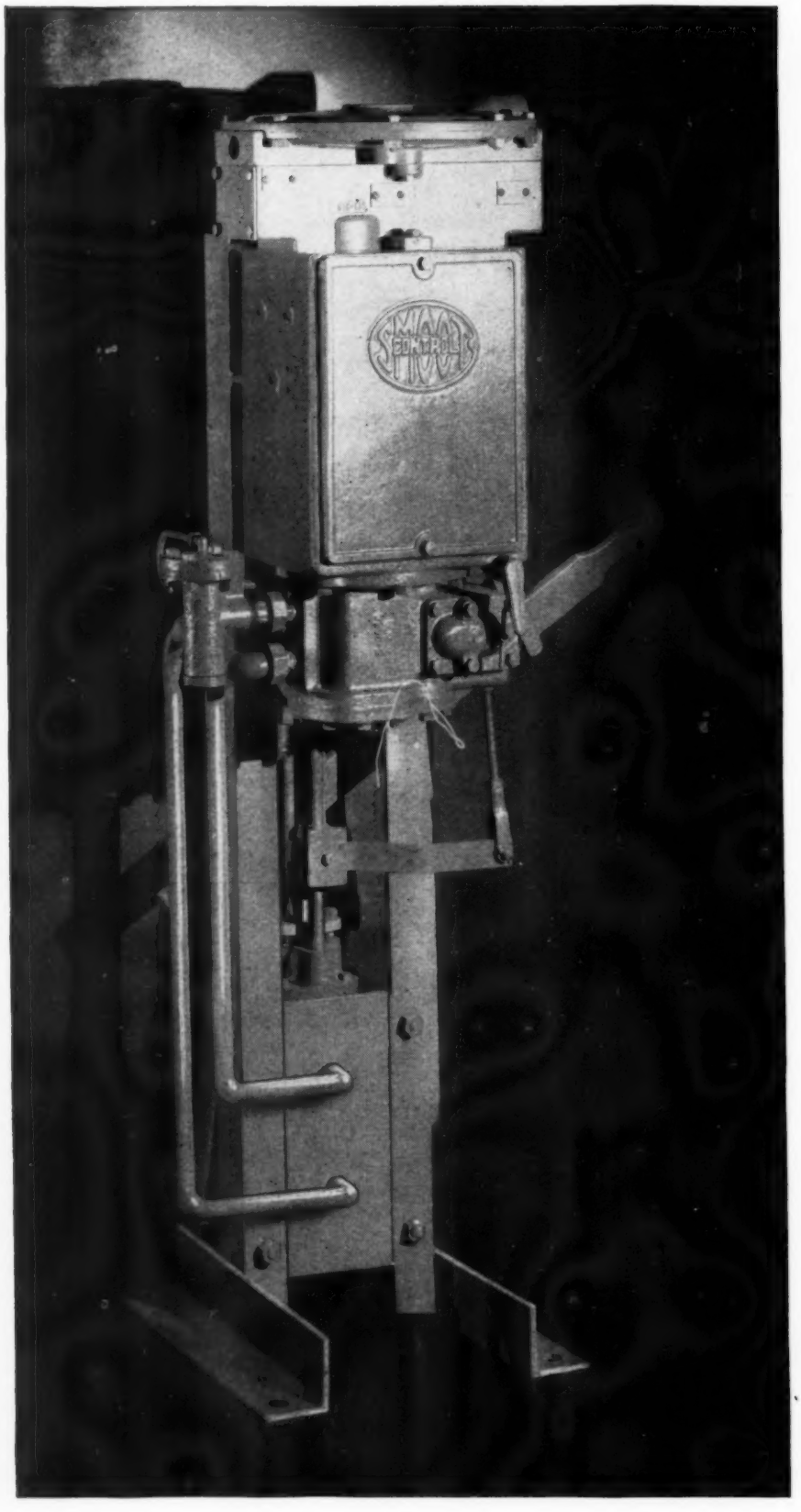




**E N G I N E E R I N G**

200 MADISON AVENUE, NEW YORK 16, N. Y.

# The Trend is to...



## REPUBLIC REGULATOR APPLICATIONS

### Pressure Control

Steam pressure control
Boiler furnace draft
Primary air pressure
Feed water pressure
Evaporator pressure
Process steam pressure
Blast air pressure
Exhauster suction
Fuel gas pressure
Suction main pressure
Excess pressure

### Flow Control

Water flow to desuperheaters
Water flow to condensers
Oil flow to boilers and furnaces
Gas flow to boilers and furnaces
Air flow to gas producers
Pump bypass

### Level Control

Hot well levels
Surge tank levels
Storage tank levels
Evaporator levels
Boiler water levels

### Speed Control

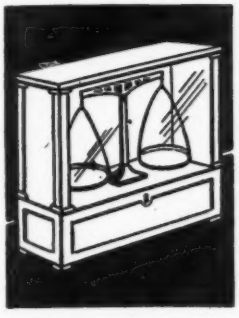
Stoker and fuel feeder speeds
Pulverizer speed
Pump speed
Fan speed
Steam turbine speed
Steam engine speed
Variable speed motors
Variable speed transmissions

**View of a Republic hydraulic type regulator for controlling boiler air flow, mounted on stand with power cylinder.**

REPUBLIC
INSTRUMENTS
AND CONTROLS

# REPUBLIC Regulators

## *Because They Meet These Four Essentials of Good Regulation*



**Republic Regulators can be made sensitive to changes of less than 0.002 of an inch of water.**

### SENSITIVITY

The amount of change that is required in the quantity being controlled to effect the regulator is the measure of its sensitivity. For close, accurate regulation, a regulator must be sensitive. It must respond immediately to the slightest deviation from the predetermined setting or the controlled quantity may vary far beyond the permissible limits.

**Republic Regulators will meet any speed requirement up to one full stroke in 2 seconds.**

### SPEED

The speed at which a regulator operates is an important factor in any control system. Any time lag between the variations in the controlled quantity and the operation of the control device to correct this variation, will produce an unnecessary error in regulation. A regulator, therefore, must be fast enough to follow the fastest load fluctuation.

**Republic power cylinders are available to meet the specific power requirements of any particular installation.**

### POWER

A regulator must have sufficient power to not only operate the valve or other control device, but also to overcome any accidental friction or sticking that may occur in any part of the system. Insufficient power will cause failure in operation. It is for this reason that regulators are made with different size power cylinders, the smaller sizes being used for small valves and the larger sizes for the larger dampers and louvers.

**The Republic stabilizer will stabilize against any time lag in the operation of the equipment being controlled.**

### STABILITY

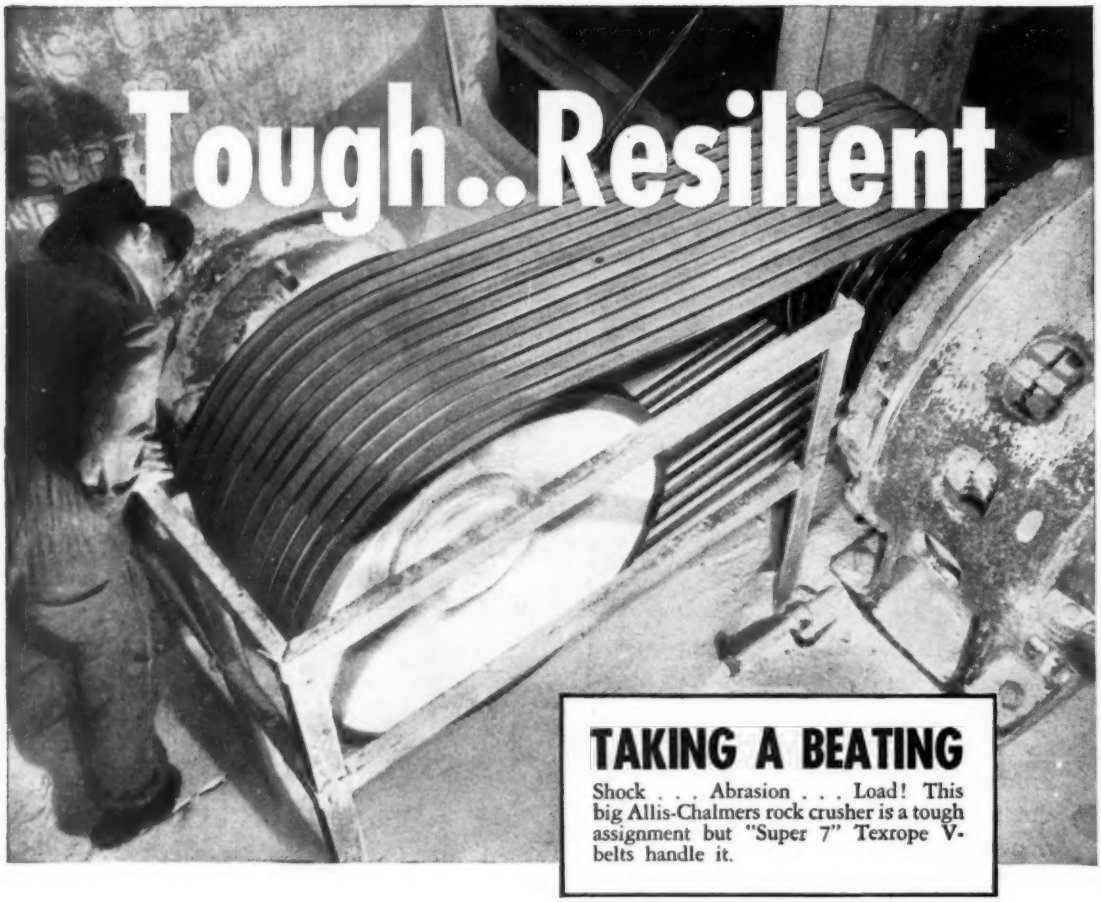
Stability refers to the ability of a regulator to maintain its balanced position or to return immediately to a balanced position if the controlled quantity is disturbed. There is always an interval between the time the valve or other control device is moved and the time the controlled quantity changes in response to this movement. Unless a regulator is stabilized it will tend to "hunt" or overtravel causing unnecessary variations.

***Write for Data Book No. S-13***

# Republic Flow Meters Co.

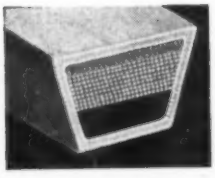
**2222 Diversey Parkway • Chicago 47, Illinois**

# Tough..Resilient



**TAKING A BEATING**

Shock . . . Abrasion . . . Load! This big Allis-Chalmers rock crusher is a tough assignment but "Super 7" Texrope V-belts handle it.



## . . . You get 7 Great Features in "Super 7" Texrope V-Belts

**1. TOUGHER COVER.** Two layers of tightly woven long-staple cotton fabric and tough, wear-resistant rubber compound. Protects the belt carcass from grit, moisture and wear — holds its shape — assures maximum belt life.

**2. SHOCK ABSORBING.** "Super 7" belts combine great strength with the degree of resiliency necessary for long life and smooth power transmission.

**3. HEAT RESISTING.** *All* "Super 7" V-belts are designed and built to give high resistance to heat.

**4. STRONGER CORDS.** More cords—imbedded in cool-running rubber compound. A powerful load-carrying structure.

**5. PRECISION CURED** in pressure molds to assure accurate section and perfect bonding of cords, cover and cushion.

**6. ACCURATELY MATCHED.** Every belt weighed, measured and carefully inspected before being sized and packed.

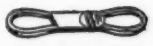
**7. ENGINEERING LEADERSHIP.** "Super 7" Texrope V-belts represent 22 years of research and experience — by Allis-Chalmers, originator of the Multiple V-belt drive.

"Super 7" Texrope V-belts come in five types to meet every operating requirement: *Standard — Heat Resisting — Oil Resisting — Oil Proof* and *Static Resisting*. Call your Allis-Chalmers office or dealer. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

A 2238

**Refer to Sweet's Catalog.**

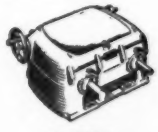
## TEXROPE .. Greatest Name in V-Belt Drives



**"Super 7" V-BELTS**
Five Types — Sizes to suit every power transmission job.

**Texsteel, Texdrive, "Magic-Grip"**
— sheaves in a full range of sizes, grooves.

**"Vari-Pitch" SHEAVES**
Exact variations in speed, stationary or motion control.



**SPEED CHANGERS**
Speed variations up to 375% at the turn of a crank.

**ENGINEERING**
Finest V-Belt engineering talent in the world—at your call.

TEXROPE "Super 7" V-Belts result from the cooperative research of two great companies — Allis-Chalmers and B. F. Goodrich. They are sold only by A-C.

# ALLIS-CHALMERS

**One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products**

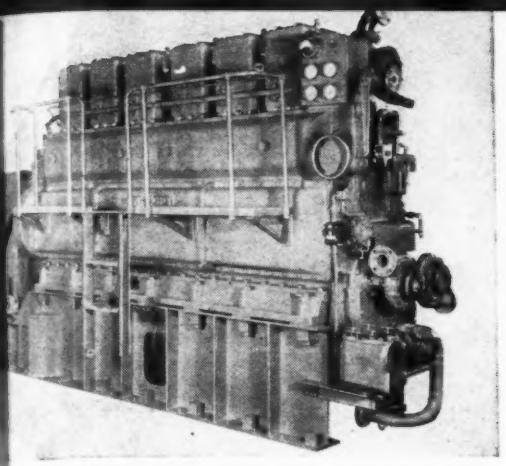
1847 1947
A CENTURY OF SERVICE to Industry THAT MADE America Great

# NEWS

FROM THE POWER FRONT

AS REPORTED BY THE DEVELOPMENT ENGINEERS, FIELD SERVICE REPRESENTATIVES AND CUSTOMERS OF WORTHINGTON

# Mountain Top Site Dictates Choice of Worthington Diesel



*Model SDH-6 Worthington four-cycle Diesel engine operating at 600 rpm with a 580-kw E-M Generator.*

The only place in the United States where abrasive garnet is mined is at the top of Gore Mountain in the Adirondacks. Garnet is an extremely hard, tough, crystal mineral used on sandpaper, in grinding wheels, in loose grain form, and in powder form as optical abrasives and abrasive compounds.

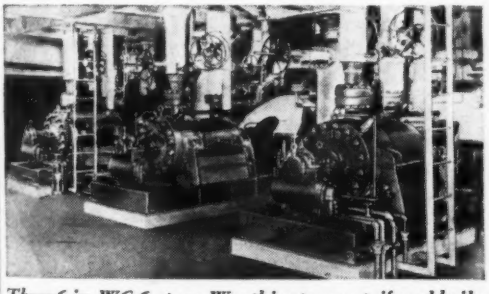
Barton Mines Corporation, the sole producer of abrasive garnet, is engaged in a program of modernizing its power facilities and is building a new full Diesel generating plant around a unit supplied by Worthington.

The new engine is a Worthington turbo-charged SDH—a heavy-duty, four-cycle Diesel, capable of producing maximum power with high, sustained economy at all loads—even at the altitude of this power plant.

### Pressure-Charged Intake

Turbo pressure-charging of a modern, four-cycle Diesel is accomplished by a single stage turbine driven by heat and energy pulsations in the engine exhaust gas, usually wasted in the exhaust silencer. This exhaust gas turbine is directly coupled to a centrifugal blower which compresses the air to a pressure of 4 or 5 lbs. Pressured air is then delivered to the individual cylinders through the conventional intake air manifold.

The fuel consumption of a turbo-charged Diesel engine is lower than comparable sizes of atmospheric-charged units. Clearing the exhaust gases from the cylinder and replacing them with clean, cool, pressured air assures more efficient combustion. The turbo-charged engine develops approximately 50% greater hp without materially increasing the internal friction load of the engine. At partial load, fuel consumption will be lower, because the unit delivers pressured air in proportion to the engine load. The fuel consumption curve is practically flat from 50% load through full load.



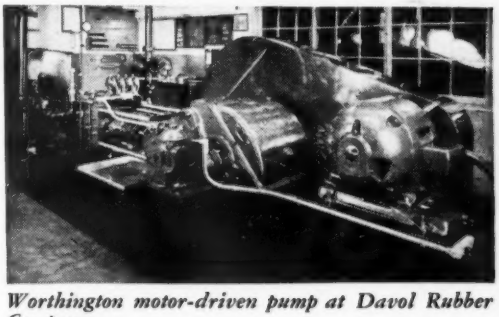
*Three 6 in. WC 6-stage Worthington centrifugal boiler feed pumps at Essex Station of the Public Service Electric and Gas Company, New Jersey.*

## 50,000 Operating Hours with Original Rotors

No wonder Public Service Electric & Gas Co. of New Jersey is installing three Worthington WCS 7-stage solid case boiler feed pumps for the 100,000 kw unit being installed in its Essex Generating Station.

In the present station, three 6 in. WCS 6-stage centrifugal boiler pumps have operated a total of nearly 150,000 pump hours in 70,000 hours of elapsed time (load is alternated at regular intervals). Two of the pumps each show 50,000 operating hours with the original rotors; the third has had a single rotor change.

Inasmuch as 30,000 operating hours is considered excellent, this performance—accomplished during a period of wartime overloads—is outstanding.



*Worthington motor-driven pump at Davol Rubber Company.*

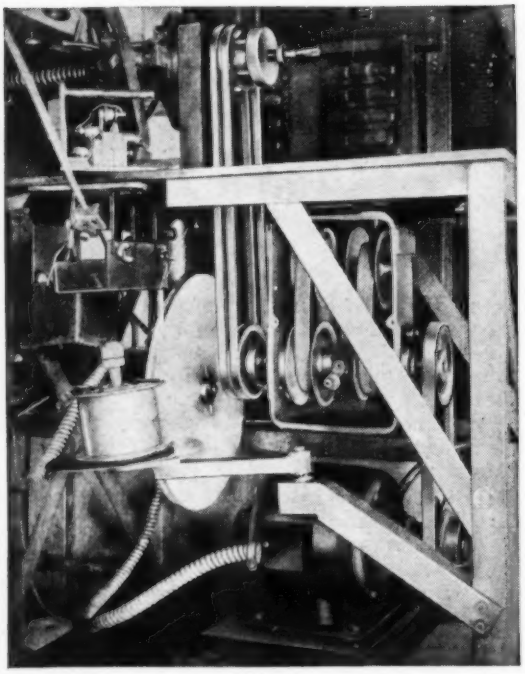
## "Practically Eliminating All Rejection," Reports Fine Rubber Goods Manufacturer

Greatly increased productive capacity and practical elimination of all rejections are the results reported by Davol Rubber Company, Providence, on the performance of their new Worthington 2000 psi hydraulic system.

This complete Worthington hydraulic system consists of a 2 x 10 KMF motor-driven pump with automatic suction valve unloaders, air bottle type accumulator, control panel with recording instrument, automatic safety shut-off valve, and charging air compressor.

A recent report states that the accumulator does not lose so much as one pound of pressure during the weekend shut down and that no air has been added to the system for a period of three weeks.

# NEWS from the power front



*Model A Allspeed Selector used by Breeze Corp. on machine manufacturing flexible metal tubing. Expansible sheaves give speed variation.*

## Production Doubled Actually! By Varying Drive Speed

At the Breeze Corporation, Newark, N. J., Worthington's Allspeed Selector accomplished a 100% increase in production by making it easily possible to start machines at lowest speed and then increase, with stepless graduation, to a top speed giving maximum machine and operator production.

On machines manufacturing flexible metal tubing, it is desirable to have a slow set-up speed of two feet of tubing per minute, and a gradual increase to a possible peak of 32 fpm. Ideal production speed is from 4 to 18 fpm on small diameters, 6 to 8 fpm on larger sizes.

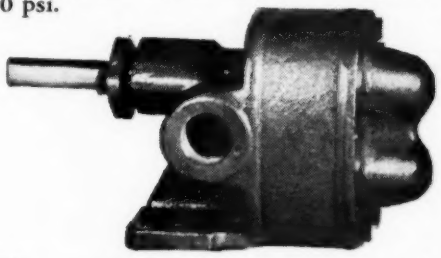
When driving from overhead belts, it was necessary to run the machines at the slow set-up speed, giving a maximum constant production speed of 3 fpm. Introduction of variable speed motors increased production speed by about 50%, but did not provide the desired flexibility in speed due to the fact that only four speeds were permitted. Moreover, it was necessary to stop the machines in order to shift speeds. Since changes in specification occur frequently, this meant a considerable loss in production.

Worthington's Model A Allspeed Selector provides the flexibility essential to top production, and eliminates the shutdowns for speed changes. And because speed is adjusted to the requirements of the material, there is also an improvement in quality.

## New Line of Rotary Pumps

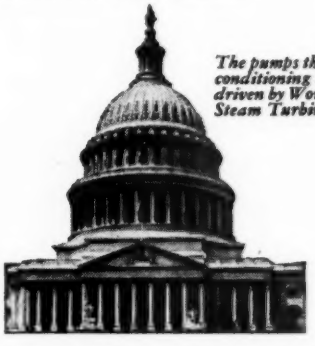
### GA ROTARY PUMP

A new line of general service rotary pumps, the GA Rotary type, has been introduced by Worthington. Six sizes are available in various mountings for capacities up to 51 gpm and 100 psi.



These small capacity rotary pumps have been designed for durability under severest service requirements, and adaptability to variety of such requirements offered by industries. Design features include four bearing construction and special herringbone rotors. Built-in pressure lubrication eliminates all external lubrication and the danger, prevalent in many industries, of liquid contamination. A production line item, the GA Rotary in its simplicity of design also offers easy maintenance and low first cost.

Models are available foot mounted or flange mounted with adjustable stuffing box and mechanical seal. They are also available with or without oversize unloader type relief valve. All models are suitable for direct coupling to electric motors of any make.



*The pumps that serve the air conditioning system here are driven by Worthington-Moore Steam Turbines.*

## Low Pressure Turbines Power Capitol Air Conditioning

In the power plant connected with the United States Capitol and surrounding buildings Worthington-Moore steam turbines are used to drive the chilled water and condenser water pumps serving the air conditioning system.

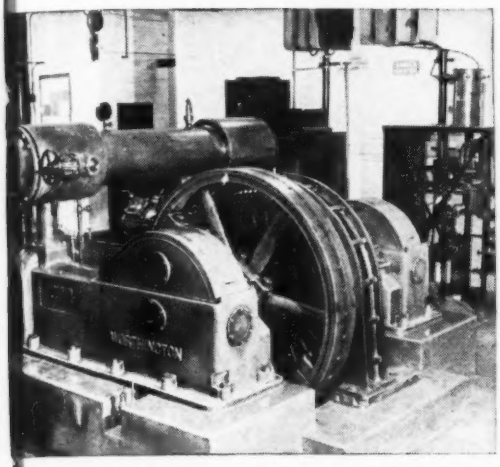
Each of the two chilled water pump turbines is rated at 800 hp, and is equipped with separate reduction gears. The turbines operate at 4500 rpm, and the gears reduce the speed to 1450 rpm.

The condenser water pump turbines are rated at 511 hp. They operate at 4500 rpm, and gears reduce the speed to 800 rpm.

In both cases, the turbines operate on steam at 40 lb. pressure and exhaust into a vacuum of 26 in.

All four turbines were installed in 1937, and they are used approximately 6 months a year, an average of 16 hours per day.

# POWER NEWS



*Worthington Compressor supplies air at 90 lb. pressure.*

## Pneumatic Equipment Thrives on Night Air

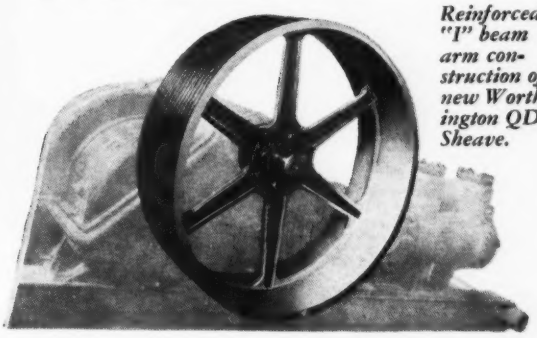
A Worthington 12 in. stroke DC2 Air Compressor installed in a New Jersey plant has been working on the night shift, delivering 1280 cfm to paint sprays, pneumatic cylinders and pneumatic shakers in the foundry, since 1939.

During a seven-year period of severe and continuous service, running from five in the evening to seven in the morning, much of the time at 100% capacity and averaging 75% for the entire shift, frequently doing emergency 24-hour service for several weeks on end, this compressor had not had a single instance of unplanned downtime.

It is run on an average of 1200 hours between changes of crankcase oil. During yearly overhaul and inspection, only minor replacements and adjustments (considered part of preventive maintenance) have been required. In 1945, the main bearings were taken down for the first time and showed very little wear; also true of the high pressure crank bearings.

## New Worthington QD Sheave Lines

Two new lines of QD sheaves, featuring improved groove-belt fit and reinforced arm construction, have been announced by Worthington. Designated as the A and B lines, each will feature individual groove size to match belt size—thus an A groove for an A belt, a B groove for a B belt. Former A-B combinations have been discontinued.



*Reinforced "I" beam arm construction of new Worthington QD Sheave.*

Like the "I" beam construction of a bridge girder, the reinforced arm construction of the new Worthington QD drive sheave incorporates a longitudinally ribbed arm recessed down the middle. Advantage of this type of arm is that material is removed at or near the neutral axis where it adds little or no strength to the arm. This material is then added at the points most remote from the neutral axis, where it gives the greatest strength.

## Packaged Power Plant Bound for Eti Bauk

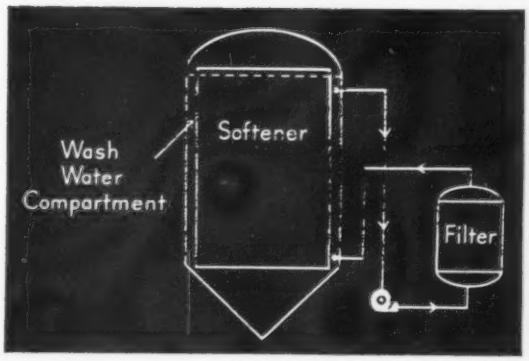
Power for the Soma Lignite Coal Mines at Eti Bauk, Turkey, will soon be coming from a Worthington Loftus-Designed Steam Power Plant, consisting of two 1000-kw units.

This power plant is a complete electrical generating station having features of portability, compactness, simplicity of design and operation, ease of assembly and disassembly, and adaptability to a wide range of climatic conditions and variations of fuel and water supply.

It is made up of the necessary items of power generation equipment arranged in relatively large, pre-assembled units which can be electrically and mechanically interconnected with the minimum of field erection time and labor.

## Worthington Hot Process Water Softener Design Eliminates Filter Backwash Troubles

Dozens of installations have proved that the usual filter difficulties are eliminated in the exclusive Worthington design which divorces the filter backwashing process from the softening process. An accumulator wash water storage and settling compartment provides clear, hot, deposit-free water for backwashing purposes thereby indefinitely prolonging the life of the filter, increasing the period between backwashing operations and decreasing the time of the operation. The filter is washed clean with clean water without disturbing the softening process.

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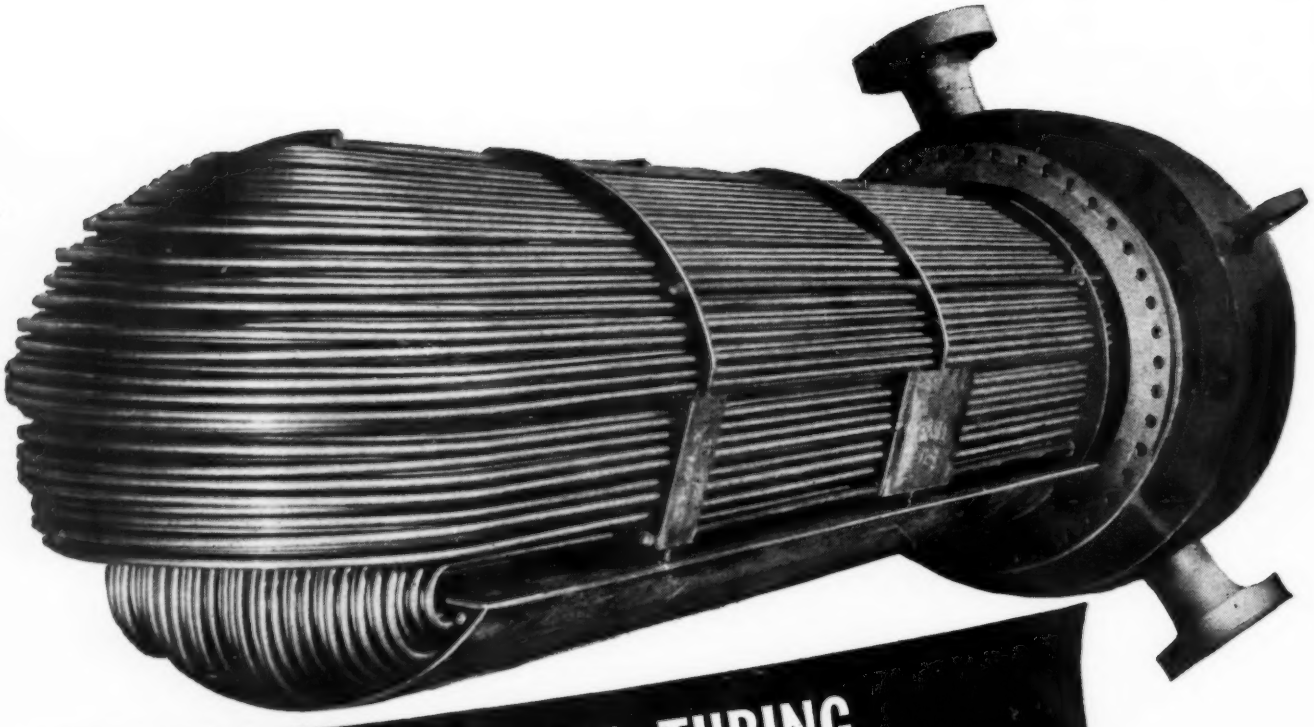

# 0.065" WALL TUBING HANDLES FEEDWATER AT 1300 P.S.I.

Here's another example of how Monel* helps solve the problems created by soaring temperatures and pressures in modern power plants...

Griscom-Russell Company's Massillon, Ohio plant built this new final-stage preheater for a tube working pressure of 2000 p.s.i., using No. 16 B.W.G. (0.065" wall) annealed Monel tubing of 3/4 inch outside diameter.

This thin-walled, corrosion-resistant Monel tubing permits preheating 439,000 pounds of feedwater per hour, from 345° to 410° F., with steam bled into the shell at 675° F. Boiler operates at 915° F. and 1225 p.s.i.

Strength of Monel greatly exceeds that of other non-ferrous tubing materials, thus permitting thinner tube walls and larger inside diameters. Result is good heat transfer with minimum pressure drop.

Even at elevated temperatures, Monel resists corrosion and offers a smooth, clean surface that retards formation of heat-obstructing jackets of scale and deposits.

In addition, Monel's hardness resists erosive wear, and its ductility allows expanding the tubes into snug-fitting, durable connections with the head.

The extraction heater above... actually a repeat order from the Narragansett Electric Company, Providence, R.I.... confirms the high efficiency of a similar Monel-tubed unit serving their Manchester Street Station since 1941.

• • •

**Other installations of Monel tubing in high-pressure power stations:**

At the Twin Branch plant of Indiana and Michigan Electric Company, subsidiary of the American Gas and Electric Service Corp., Monel tubing was installed in a preheater handling 550,000 pounds of water an hour at 3200 pounds pressure per square inch—under external temperature of 637° F.—feeding a boiler operating at 2500 pounds steam pressure!

In the Oswego plant of the Central New York Power Corp., Monel heater tubing was installed to operate under 2000 pounds water pressure, at an outside temperature of 770° Fahrenheit.

If you have problems involving metals for equipment now in production or planned, consult INCO Technical service... make use of the wide experience of our engineering staff. Write:

**THE INTERNATIONAL NICKEL COMPANY, INC.,** *67 Wall Street, New York 5, N.Y.*

EMBLEM OF SERVICE

**NICKEL INCO ALLOYS**

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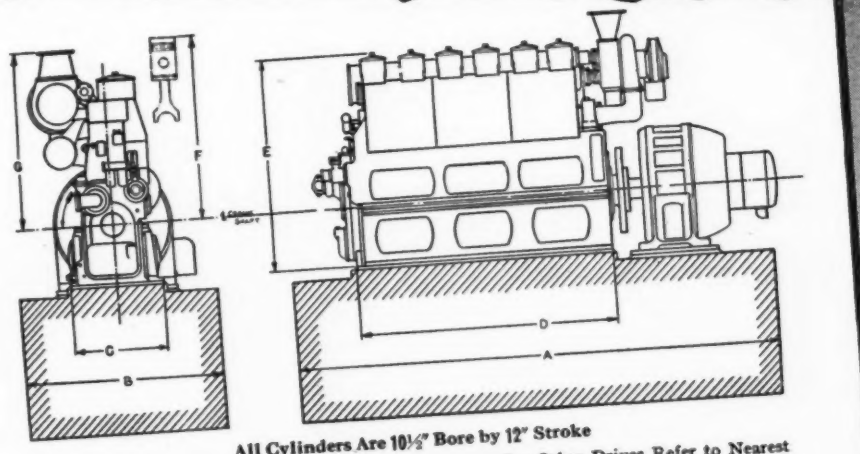
*Reg. U.S. Pat. Off.




All Cylinders Are 10½" Bore by 12" Stroke

Dimensions Based on Standard Sixty-Cycle Generator. For Other Drives Refer to Nearest Branch Office.

| Type | HP | No Cyl. | RPM | Dimensions in Feet and Inches | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | A | B | C | D | E | F | G |
| S | 225 | 3 | | 14-0 | 7-0 | 3-4 | 4-10 | 7-1 | 6-3 | |
| S | 300 | 4 | | 14-0 | 7-0 | 3-4 | 6-2 | 7-1 | 6-3 | |
| S | 375 | 5 | 720 | 14-0 | 7-0 | 3-4 | 7-6 | 7-1 | 6-3 | |
| S | 450 | 6 | or | 14-0 | 7-0 | 3-4 | 8-10 | 7-1 | 6-3 | |
| S | 525 | 7 | 750 | 18-6 | 7-0 | 3-4 | 10-2 | 7-1 | 6-3 | |
| S | 600 | 8 | | 18-6 | 7-0 | 3-4 | 11-6 | 7-1 | 6-3 | 6-0 |
| SS | 675 | 6 | | 14-0 | 7-0 | 3-4 | 8-10 | 7-1 | 6-3 | 6-6 |
| SS | 785 | 7 | | 18-6 | 7-0 | 3-4 | 10-2 | 7-1 | 6-3 | 6-6 |
| SS | 900 | 8 | | 18-6 | 7-0 | 3-4 | 11-6 | 7-1 | 6-3 | |

**These..**

# are the TYPE "SS" SUPERCHARGED I-R DIESELS

They are built in three sizes . . . 6 cylinder for 675 hp—7 cylinder for 785 hp—8 cylinder for 900 hp. They develop 50% more power than unsupercharged Type "S" engines having the same number of cylinders and yet retain all the proven advantages of the Type "S" . . . reliability, economy, accessability, low maintenance.

There are other advantages too.

Low fuel consumption (.38 lb per bhp-hour at three-quarter and full load, .40 at half load.)

Less derating at altitudes than in an unsupercharged engine.

Low lubricating oil consumption because increase in power is not obtained by adding cylinders, bearings or similar parts.

Operation of the turbocharger is entirely automatic.

Less Space. An 8 cylinder "Super S" engine requires only 2/3 the floor space and weighs only 66% as much as an unsupercharged engine of equal horsepower.

If you're thinking of a Diesel installation, get in touch with an Ingersoll-Rand Branch Office. Talk it over with our engineers and see just what these turbocharged Diesels will save you.

COMPRESSORS • AIR TOOLS
ROCK DRILLS • TURBO BLOWERS
CONDENSERS • CENTRIFUGAL PUMPS
OIL & GAS ENGINES

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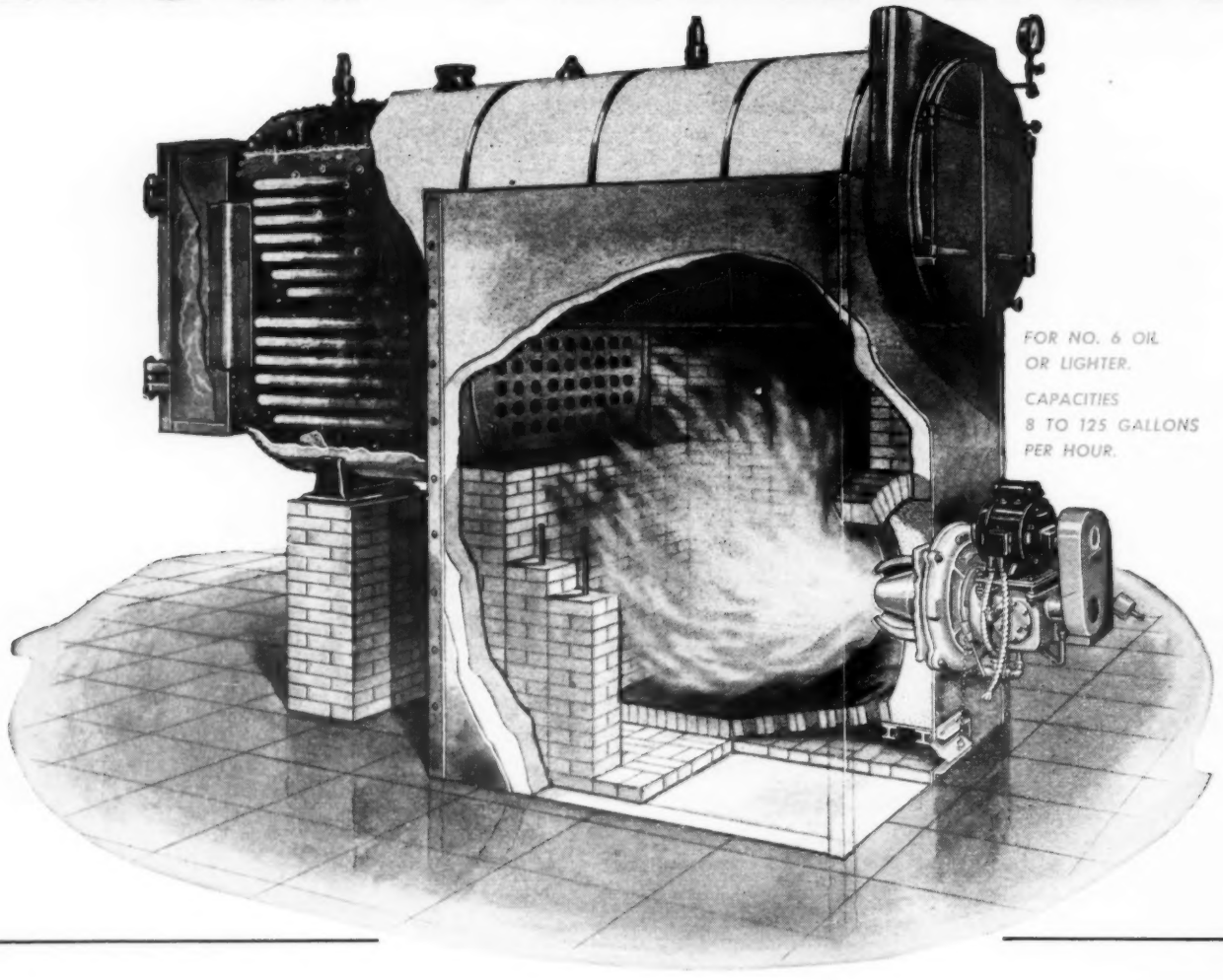
# IRON FIREMAN



FOR NO. 6 OIL OR LIGHTER.

CAPACITIES 8 TO 125 GALLONS PER HOUR.

## Outstanding Features of the Iron Fireman Heavy Fuel Oil Burner

OIL VOLUMETER

The Iron Fireman Oil Volumeter is a positive displacement, variable volume pump, submerged in the oil reservoir for the purpose of metering oil to the rotary atomizing cup. It requires no feed valve, adjustable port, or viscosity compensating device, because the amount of oil fed to the burner is determined by the movement of pistons in multiple cylinders. The rate of oil feed is governed by the length of the piston stroke, which is controlled by a simple cam mechanism. Oil temperature or viscosity has no effect upon the feed rate.

DUAL PUMP AND RESERVOIR

Gear-type pump with return flow to tank maintains full reservoir with reserve oil capacity. Air from suction line is automatically vented from top of reservoir. Therefore the oil in which Oil Volumeter is submerged is always free from air.

V-BELT DRIVE—STANDARD MOTOR

V-belt drive permits replacement of motor in a few minutes. Motor is standard 1750 r.p.m. in standard N.E.M.A. frame sizes.

NON-CARBONIZING FLAME SHAPER

Shape of flame may be adjusted to fit proportions of combustion chamber. Adjustable vanes controlling the shape of the primary air stream, and thus the flame, are located well back of the oil nozzle to prevent fouling by carbon deposits.

SINGLE CONTROL LEVER

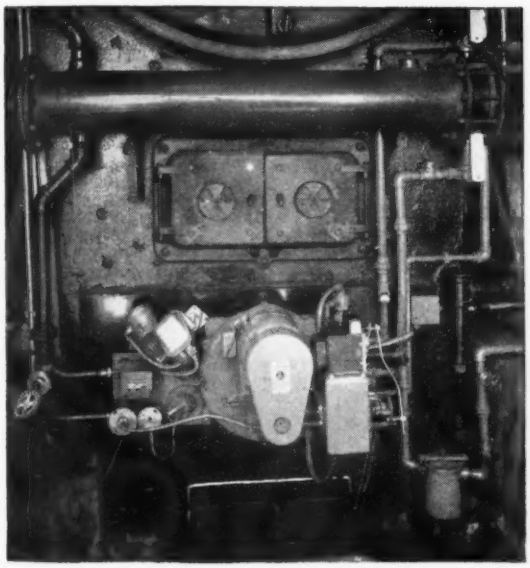
A single control lever, that may be positioned manually or automatically, regulates supply of oil to burner. Direct linkage from this lever to primary air dampers maintains correct air-fuel ratio as firing rate is changed.

HEAVY DUTY OIL BURNERS AND STOKERS

IRON

# Industrial Oil Burner

## Announcing a new principle of heavy oil control that produces a steady, even flame regardless of oil temperature and viscosity



Typical installation of Model RAH Iron Fireman Oil Burner, rated at 55 gallons per hour with Bunker C fuel oil. Minimum fire 13 gallons per hour. Boiler has 1,070 sq. ft. of heating surface. This burner has full automatic modulated fire control, with modulating type aquastat located in heating return line at junction with vacuum and condensate pumps, giving continuous operation. Equipment includes electronic combustion safety control and gas-electric ignition with low fire start.

## Solves toughest problem in firing heavy oil

With changing temperatures, heavy fuel oils vary greatly in fluidity. Even when oil temperature is accurately controlled, the characteristics of this type of fuel make it very difficult to regulate the flow by means of ports and valves. Erratic flow of fuel oil to the burner produces a pulsating fire, makes it impossible to throttle the burner down to a low burning rate, and often causes starting failure in a cold boiler room.

The Iron Fireman Industrial Oil Burner provides an accurate, positive *oil volume* control which delivers a metered, steady volume of fuel at the burner head whether the oil is hot or cold, thick or thin.

### Positive control of firing rate

Since precise control of the oil feed rate is completely independent of the viscosity of the oil, the Iron Fireman Industrial Oil Burner produces a steady, even flame in which fuel and air are always under such exact control that there is no pulsation even when the burner is throttled down to low capacity.

Control of the fuel feed rate centers in a single lever, which may be manually or automatically operated. Automatic or semi-automatic control combinations can be provided for almost any application of intermittent or modulated firing.

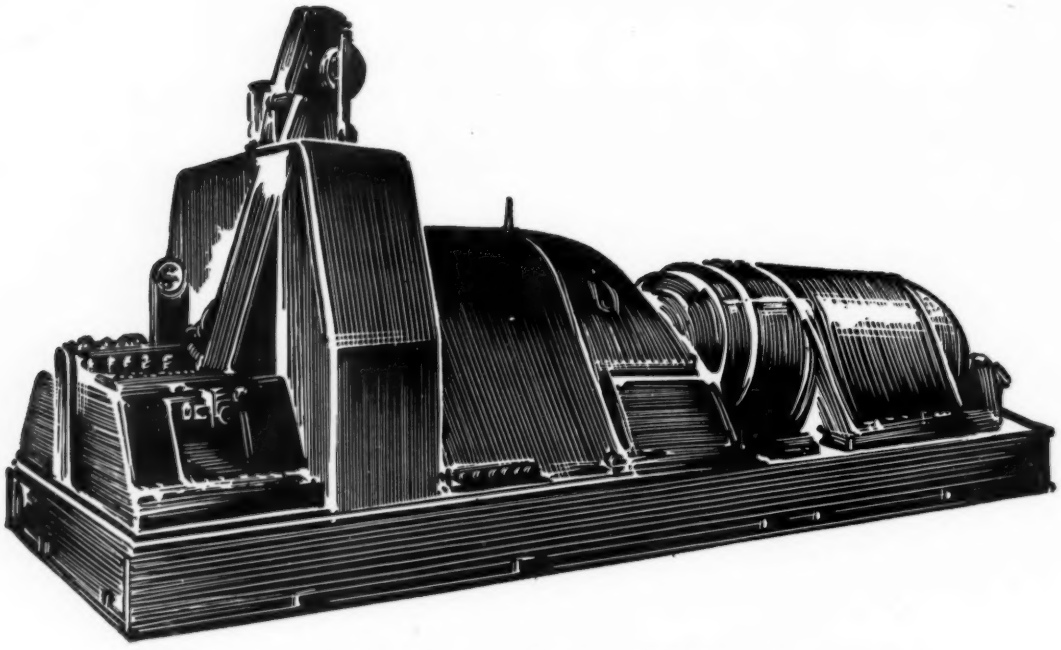
### Complete dependability

Experienced engineers will not be surprised at the performance record of the Iron Fireman Industrial Oil Burner when they have a chance to examine its design. Exceptional performance characteristics are easily recognized in the simplicity and practicality of its engineering, the main features of which are outlined on the opposite page.

***Send for folder.*** Further information will be sent upon request. Iron Fireman's nation-wide sales, service and engineering organization is available to you now for consultation, as well as for a free survey of your boiler room if you so desire. Write to Iron Fireman Manufacturing Co., 3104 W. 106th St., Cleveland, Ohio. Other plants in Portland, Oregon; Toronto, Canada.

**FIREMAN**

**FOR POWER, PROCESSING AND HEATING**



# POWER IS CHEAP

## WHEN PRODUCED AS A BY-PRODUCT

Wherever steam also is required in appreciable quantities for heating or processing, power can be produced at surprisingly low cost with a turbine designed for extraction or back pressure service. Often the cost of the small amount additional fuel required to produce power is so low that the entire equipment investment can be repaid in a few years' time.

Whether or not you can save money by producing your own power can be definitely determined from cost figures submitted by our engineers.

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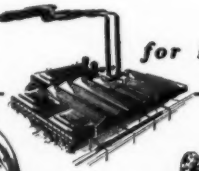
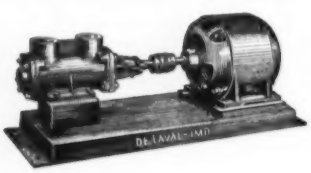
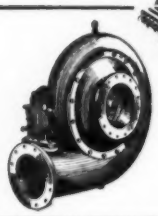
*De Laval*  *for Industry*





T-11

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# LET IT RAIN! LET IT SNOW!

It's a fact! Feed the Æ Perfect Spread Stoker any grade of coal and watch it operate perfectly—without clogging, whether your coal supply is wet, dry, or partially frozen. This and many other operating features are exclusive with Perfect Spread and are not available in any other stoker.

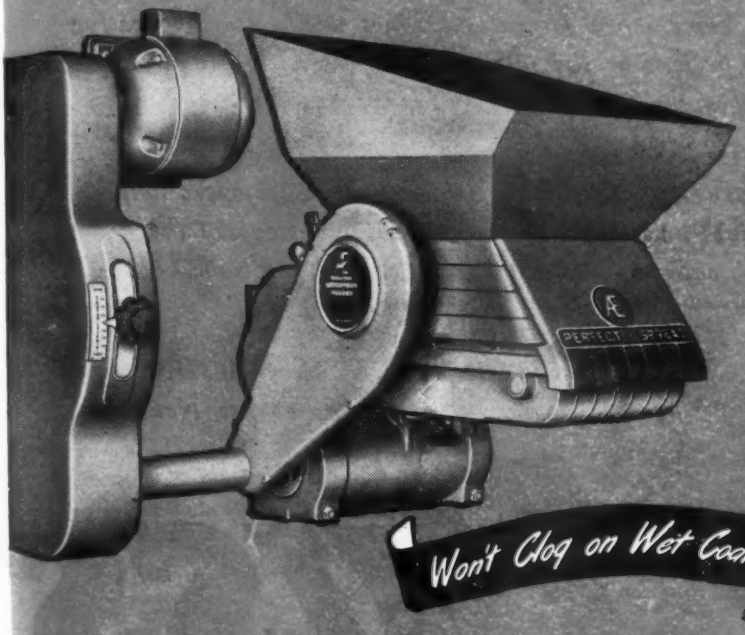
But "the proof of the pudding is in the eating." With scores of Perfect Spread Stokers in operation and production going full speed to satisfy the large number of orders promptly, it is evident that the Æ Perfect Spread Stoker is accepted as a highly efficient and economical stoker. Before buying any fuel firing equipment, investigate! Write for descriptive booklet today!

WET COAL WON'T CLOG

## PERFECT SPREAD STOKER

WITH TRAVELING, DUMPING OR STATIONARY GRATES

THIS STOKER



Won't Clog on Wet Coal!

The Perfect Spread Stoker has a record of proved economy and cost-cutting efficiency in many industries—over an 18-year period.

Æ

**FREE**—Get this valuable descriptive booklet on the Æ Perfect Spread Stoker today!

Address inquiries to 2400 Aramingo Ave., Philadelphia 25, Pa.

Other Æ Products: Æ-TAYLOR STOKERS, LO-HED HOISTS MARINE DECK AUXILIARIES, HELE-SHAW FLUID POWER

**AMERICAN ENGINEERING COMPANY**

2400 ARAMINGO AVENUE, PHILADELPHIA 25, PA.

# FUSETRONS

## Hold Harmless Overloads–
## Prevent Needless Shutdowns

### Many Companies Have Proven It...

*For Example–*

*"Formerly we were troubled by two kinds of needless fuse blowings in our milling machine department. Frequently the operators take too deep a cut in the material on which they are working, building up a momentary overload. Ordinary fuses blew so frequently on this type of overload that it was necessary to install oversize fuses, robbing the circuit of proper protection.*

*"Our other difficulty came when several machines would start operating simultaneously after rest periods or the lunch hour, blowing the fuses in the main switch, thus shutting down all the machines of the department.*

*"In June, 1945, Mr. Edward Lambert, our Chief Electrician, solved both difficulties by installing 20 ampere 250 volt Fusetrons in the 30 ampere switches on the individual machines and 200 ampere 250 volt Fusetrons in the main switch. He reports that no outages have occurred since that was done."*

*Lloyd B. Benham, V. P.*
*PORTER CABLE MACHINE CO.*
*Syracuse, New York*

**BUSS**

# Keep Electrical Equipment Operating Without Sacrificing Protection

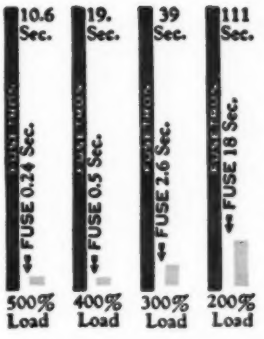



Chart shows 30 ampere 250 volt fuses. Other sizes and 600 volt ratings show similar results.

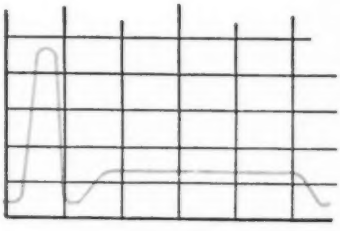
Buss Fusetrons have tremendous time-lag. They *can* hold harmless overloads, yet provide protection against dangerous overloads or short-circuits because they combine a fuse with a thermal cutout.

Here's how the time-lag of Fusetrons compares with that of ordinary fuses:

It is readily seen from this chart why Fusetrons hold harmless overloads and keep circuits operating instead of opening and causing useless shutdowns. Ordinary fuses and other protective devices cannot do this job.

Here's how Fusetron time-lag will work for you. AC motors require a current of 3 to 9 times their rating for starting. This surge of current often causes ordinary fuses to open.

Fusetrons have the capacity to absorb this high starting current without opening, even when the type of load causes starting current to hang on for limited periods.



In normal operation overloads often occur that are heavy but short lived—or light overloads hang on. In either instance they are harmless—yet they may cause ordinary fuses to open.

Fusetrons hold such harmless overloads—and keep circuits in operation.

### *Fusetrons Also Prevent Needless Blows on Mains and Feeder Circuits*

Even when all motors on a circuit start at one time, Fusetrons will not open. For example: four 15 ampere motors on a circuit would ordinarily be protected by 90 ampere fuses. If these 4 motors start at one time the combined starting current is approximately 360 amperes. At this load a 90 ampere fuse would open in about 3 seconds—before the motors could start—BUT A 90 AMPERE FUSETRON WILL HOLD 24 SECONDS, ample time for all motors to start.

So, with Fusetrons installed in the mains, feeders and all branch circuits, shutdowns caused by needless opening of fuses or other forms of protective devices on harmless overloads are entirely wiped out.

## Fusetrons Give Many Other Kinds of Protection Heretofore Not Available

### *What is a* FUSETRON?

The Fusetron is a DUAL element device—a Fuse to which is added a Thermal cutout.

The result is a fuse with tremendous time-lag and much less electrical resistance.

Fusetrons have the same degree of Underwriters' Laboratory approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses, Fusetrons fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere in both 250 and 600 volt types. Also in tamper-resisting type (Fustats) for 125 volt circuits.

Their cost is surprisingly low.

***Fusetrons do everything fuses do, as is confirmed by the Underwriters' Laboratories' Label, and in addition . . .***

★ Provide simplest way to stop burnouts from single phasing. ★ Make burnout protection of SMALL motors simple and inexpensive. ★ Give thermal protection to panelboards and switches. ★ Prevent needless blows caused by heating in panels and switches. ★ Permit use of larger motor or adding more motors on circuit without installing larger switch or panel. ★ On new installations, proper size switches and panels can be used instead of oversize. ★ Protect motors against burnout. ★ Give double burnout protection to large motors. ★ Protect coils, transformers and solenoids against burnout.

### *Get All The Facts—Get Better Protection Send The Coupon Now*

Only one shutdown, or one lost motor or one destroyed panel may cost you far more than replacing every fuse with a Fusetron.

Don't risk such losses—protect your production schedules by changing your entire electrical system to FUSETRONS.

BUSSMANN MFG. COMPANY, University at Jefferson St. Louis 7, Mo.
*(Division McGraw Electric Co.)*

# FUSETRONS

**SOLD THROUGH WHOLESALERS**

BUSSMANN MFG. CO., University at Jefferson St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about BUSS Fusetrons.

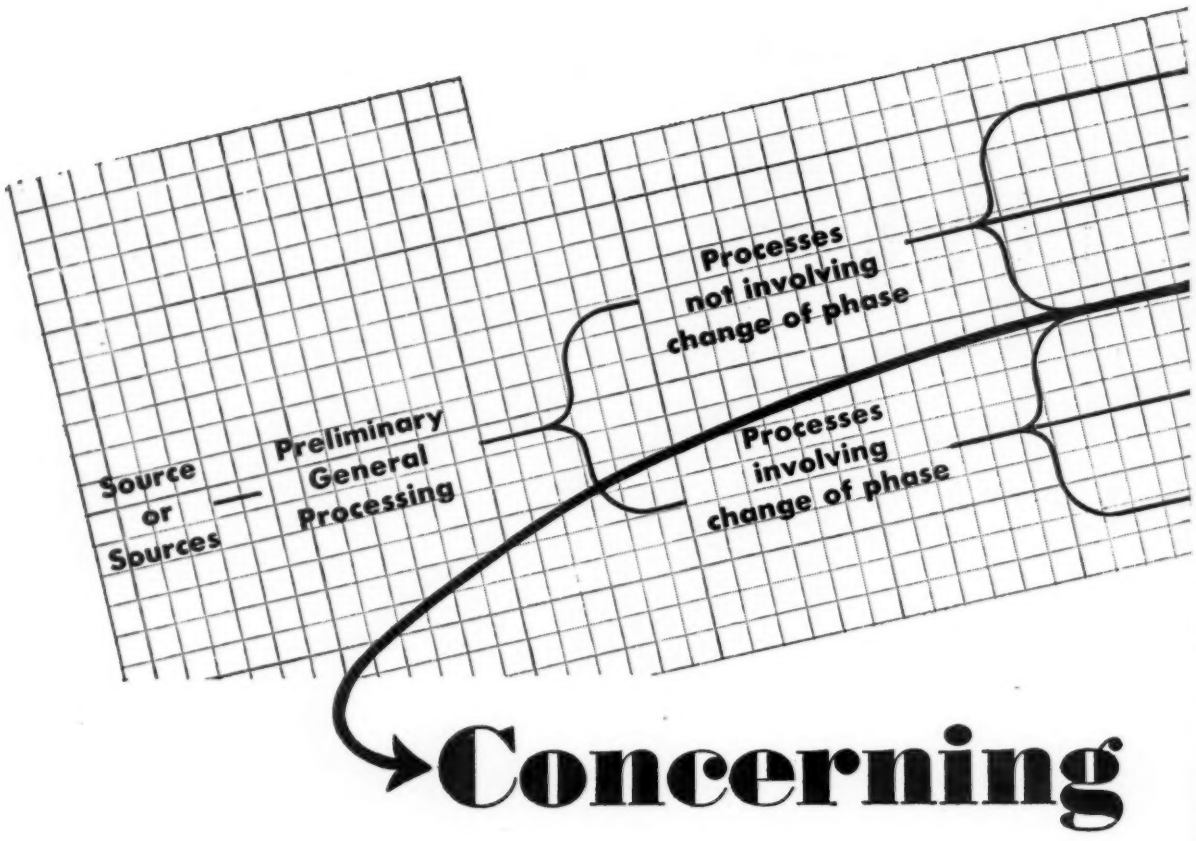
Name_____

Title_____

Company_____

Address_____

City_____ State_____ 747


Source or Sources
Preliminary General Processing
Processes not involving change of phase
Processes involving change of phase

# Concerning

Some years ago, an eastern electric company planned to build a new plant on an ocean-front site. Water for the boilers was to be supplied by wells, and salt water used in the condensers.

### Water Highly Corrosive

When the sea water was analyzed, however, it was found to be badly contaminated by waste from a near-by industrial plant. From their experience with similar contamination, Hall engineers were able to show that replacement of condenser tubes because of corrosion would reach prohibitive levels. Treatment of the water to inhibit corrosion would be impracticable because of the degree of contamination and the volume of water required.

Use of well water was considered, but the supply was inadequate for a "once-through" system, and humidity records for the area showed that cooling towers or spray ponds would be too inefficient.

Another site in the area was found to be suitable, as far as conditions then existing were concerned, but was ruled out because of the probability that contamination would increase in the future.

The most efficient and economic solution found was to locate the plant in an entirely different area.

This case was unusual because each of the courses considered depended on a single dominant factor.

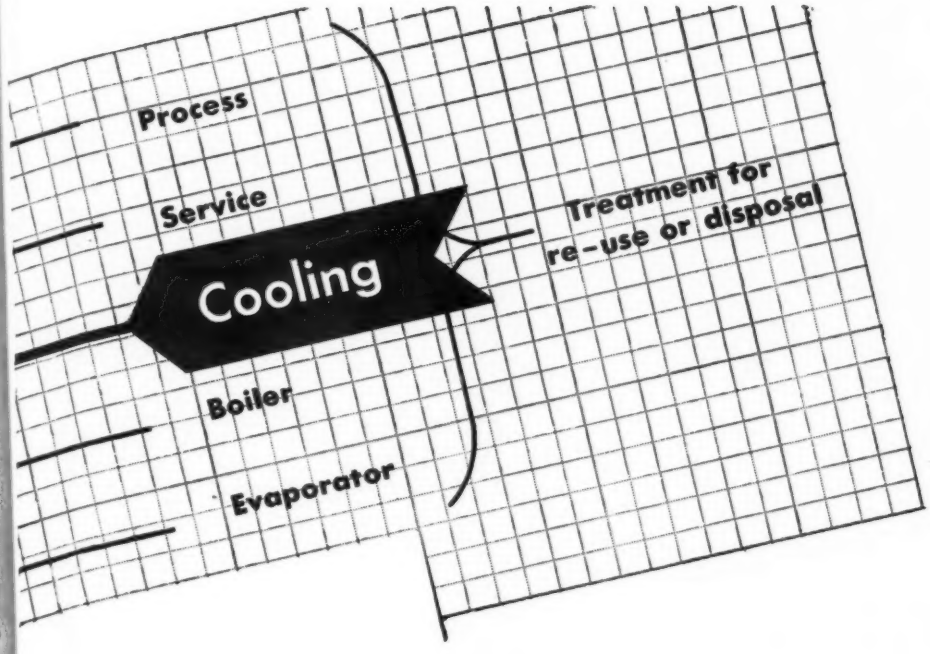
In most situations, problems of cooling water are complex, involving study of many characteristics of the available waters, consideration of methods of water treatment and thorough knowledge of cooling systems.

### Bacteria Create Problem

In some cases, bacteria may create a major problem. Some types may produce slime, to an extent that may result in plugging of the inlet ends of the cooler. In well water systems, if sulfate reducing bacteria are present, hydrogen sulfide is formed and corrosion will thus be greatly increased. Other bacteria may cause the production of various harmful iron compounds.

To destroy these and other microbiological organisms, the water must be treated with chlorine, or other chemicals. But—what treatment should be used? How much? How should it be applied and where? Should treatment begin at the well, for example, or at some other point in the water supply system?

Other water characteristics must be studied,




# cooling water

such as the amount and type of suspended or dissolved solids; hardness; the presence of organic matter or of contaminating substances from other plants. These, too, must be taken into account in planning treatment.

When spray ponds or cooling towers are used, some of the water undergoes *change of phase,* and this, in turn, involves greater concentration of impurities in the water which remains—and this concentration brings additional problems.

### Importance of Service

Service in connection with all of these problems must be continuous, for the problems themselves change from day to day, from season to season and from year to year. Furthermore, these changing problems must be solved in relation to all other plant water problems, from the problem of selecting a source to the problem of ultimate disposal of waste.

*Every problem concerning the use of water in industry comes within the scope of Hall Laboratories.*

### Answers to Your Specific Problems

Hall Laboratories not only understands these problems but knows their implications in plant construction and operation—knows that the answer must ultimately be in terms of dollars and cents. Hall Laboratories is prepared to recommend procedures which, taking all factors into account, represent the most economic and efficient solution *in your specific situation.*

Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pennsylvania.

## HALL LABORATORIES, INC.

**(A Subsidiary of Hagan Corporation)**

HAGAN
HALL
BUROMIN
CALGON

CONSULTANTS ON
INDUSTRIAL WATER TREATMENT
HALL SYSTEM OF BOILER WATER CONDITIONING
INDUSTRIAL WASTE RECOVERY AND DISPOSAL

# CHECK THIS SCOREBOARD

## before you buy wire and cable for Severe Service

| | INSULATION | HEAT RESISTANCE | AGE RESISTANCE | OIL, GREASE, FUMES | FINAL SCORE |
|---|---|---|---|---|---|
| ORDINARY WIRE | ? | ? | ? | ? | ? |
| ROCKBESTOS WIRES AND CABLES | IMPREGNATED ASBESTOS INSULATION FOR PERMANENCE | WON'T BAKE BRITTLE, CRACK OR FLOW UP TO 230° F. | TIME DOESN'T DETERIORATE ASBESTOS | INSULATION WON'T ROT, BLOOM SWELL OR BURN | LOWER MAINTENANCE EXPENSE AND LASTING PROTECTION AGAINST CIRCUIT FAILURES AND EQUIPMENT BREAKDOWNS |

You get *big league* performance and value for your wire and cable money when you install Rockbestos A. V. C. in trouble-making circuits. Because of their *permanent insulation* of impregnated asbestos, Rockbestos Type AVA wires and cables will take temperatures up to 230° F. *continuously* without baking brittle, cracking or flowing. And for other maintenance-reducing advantages you can cash in on — they won't deteriorate with age; won't rot or bloom when in contact with fumes, grease or oil; and won't burn or carry flame.

A variety of constructions in 600 to 5000 volt ratings includes single and multi-conductor power cables, switchboard and lighting wires, control cables and other National Electrical Code types. Write for catalog, recommendations or samples.

**ROCKBESTOS PRODUCTS CORPORATION**
**196 Nicoll Street, New Haven 4, Conn.**

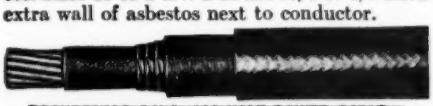
# ROCKBESTOS A.V.C.

***The Wire with Permanent Insulation***

NEW YORK BUFFALO CLEVELAND DETROIT CHICAGO PITTSBURGH
ST. LOUIS LOS ANGELES SAN FRANCISCO SEATTLE PORTLAND, ORE.

**ROCKBESTOS A.V.C. 600 VOLT BOILER ROOM WIRE—TYPE AVA**

Varnished cambric, impregnated asbestos and a heavy asbestos braid make this wire ideal for lighting and control circuits exposed to heat and moisture or corrosive fumes around furnaces, boilers, lehrs, ovens, soaking pits, etc. Sizes 18 to 8 AWG as above, 6 to 4/0 have extra wall of asbestos next to conductor.



**ROCKBESTOS A.V.C. 600 VOLT POWER CABLE—TYPE AVA**

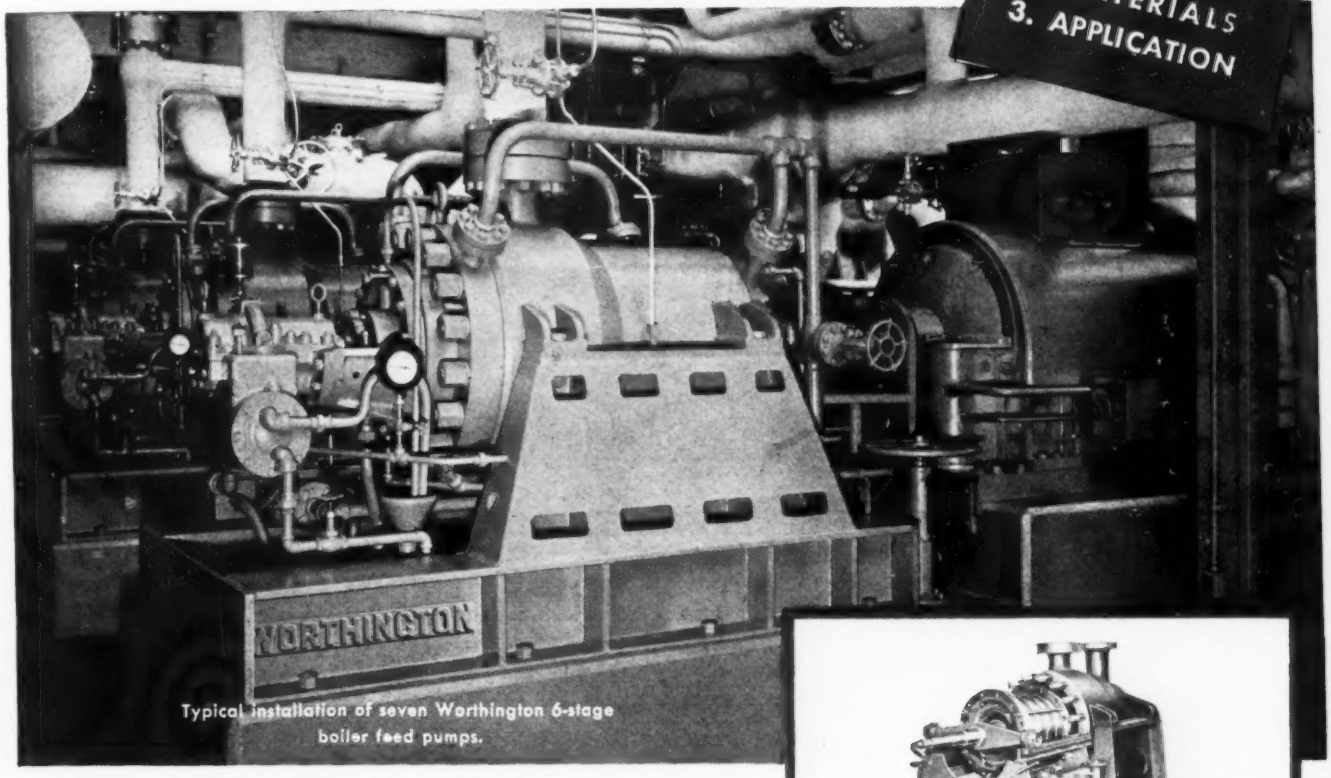
Insulated with impregnated asbestos and varnished cambric and covered with asbestos braid, like Rockbestos A.V.C. Motor Lead Cable, this cable withstands high ambient temperatures in power circuits and heat-exposed equipment. Also resistant to oil, grease, moisture and flame. Sizes 18 AWG to 2,000 MCM.

**ROCKBESTOS A.V.C. 600 VOLT CONTROL CABLE**

In one to 19 conductors with individuals insulated like Power Cable above, coded cotton braids, and either asbestos, lead sheath, armor, or lead and armor overall. For permanence under heat and moisture and corrosive fumes. Strandings AWG 12—19/#25 and AWG 9—19/#22. Others on order.

# WHY WORTHINGTON HIGH-PRESSURE PUMPS *excel in all three . . .*

1. DESIGN
2. MATERIALS
3. APPLICATION



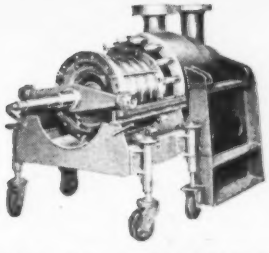

Typical installation of seven Worthington 6-stage boiler feed pumps.

**1. DESIGN** —Worthington has longer experience in manufacturing high-pressure centrifugal boiler feed pumps . . . has acquired unique constructive ideas from power-plant operating engineers. That's why you'll find such superior design features in Worthington high pressure boiler feed pumps as: a balancing device construction that minimizes wear; bolted ring-type pressure joints; impellers shrunk on the shaft; oversized Kingsbury thrust bearings.

**2. MATERIALS** —Worthington has greater facilities for research. That's why you'll find the *right* materials in Worthington high-pressure boiler feed pumps: stainless steel for internal parts—to prevent destructive corrosion and erosion; forged steel casings—tested and proved by years of power plant operation.

**3. APPLICATION** —Worthington Pump Application Engineers are thoroughly versed in every phase of applying the most complete line of boiler feed pumps for high or low pressures — capacities from 50 to 3500 GPM . . . pressures from 50 to 2500 PSI. That's why Worthington will fit the *right* feed pumps to your feed cycle.

For further details on Worthington High-Pressure Boiler Feed Pumps . . . or for an appointment with a Worthington P.A.E.*, write us or telephone the nearest of our 36 district offices. You'll find that *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Centrifugal Pump Division, Harrison, N. J.*



**AS EASY TO DISMANTLE AND ASSEMBLE AS A SPLIT-CASE PUMP**

Complete rotor assembly of Worthington High-Pressure Boiler Feed Pump can be withdrawn *in one piece* on a portable assembly truck without disturbing suction or discharge piping connections. Simplifies inspection, replacement or repair of internal parts.

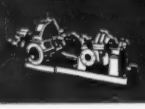
*Pump Application Engineer

**WORTHINGTON**

24CS-3

**THE WORLD'S LARGEST MANUFACTURER OF PUMPS**

For Boiler Feed Service
Capacities from 30 to 1500 g. p. m. Heads from 180 to 1000 feet.



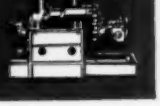
For Hotwell, Condensate, Chilled Water, General Service
Capacities from 150 to 1300 g. p. m. Heads from 110 to 500 feet.

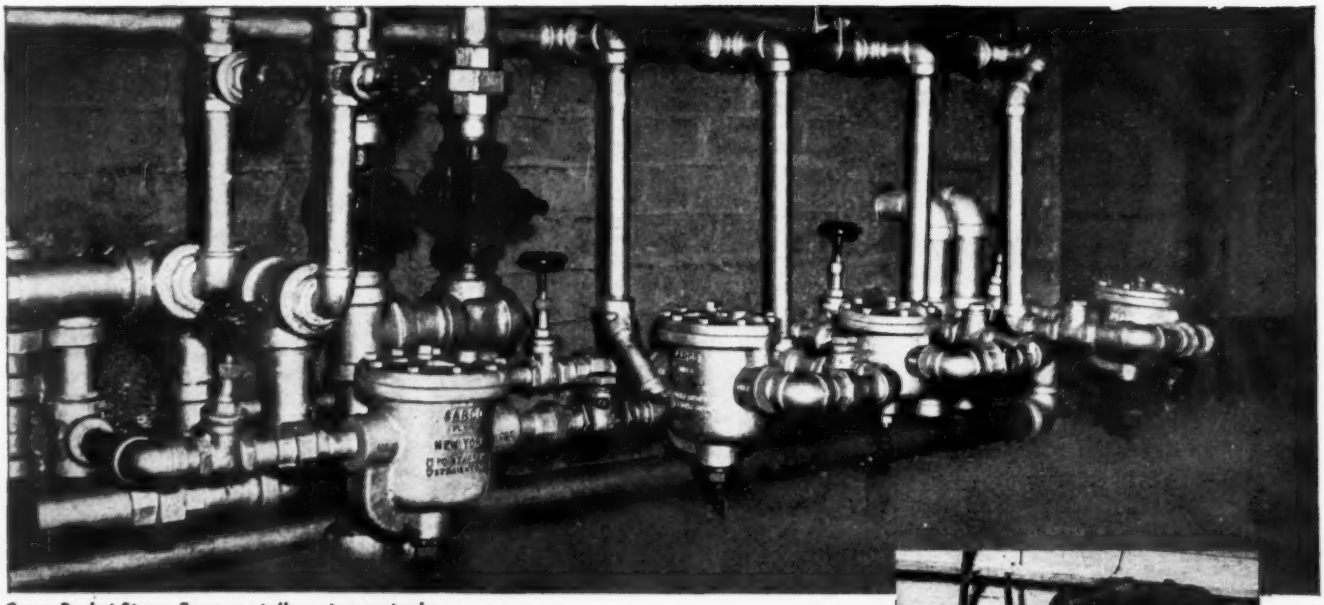
For Boiler Feed Service
Capacities from 25 to 1450 g. p. m. Heads from 220 to 1600 feet.

For Water Works, Circulation, Drainage, General Service
Capacities from 500 to 1600 g. p. m. Heads 900 to 3200 feet.

For Boiler Feed Service
Capacities from 200 to 1600 g. p. m. Heads from 900 to 3200 feet.

For Boiler Feed Service
Capacities from 500 to 3000 g. p. m. Heads from 2000 to 7000 feet.





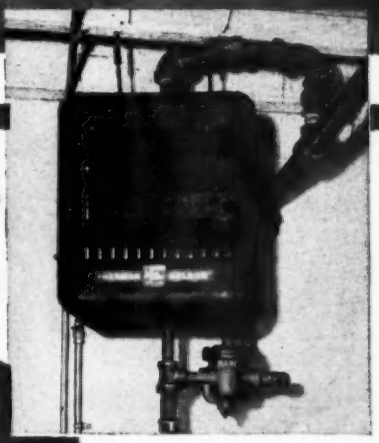
*Sarco Bucket Steam Traps on tallow storage tanks.*

# SARCO BUCKET STEAM TRAPS AGAIN — FOR MEAT PRODUCTS

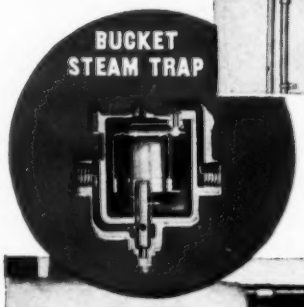
Hundreds of food products plants are struggling along with production shut-downs, slow-ups and waste due to incorrect steam traps —or no traps at all.

This Chicago meat products plant has no such problems because the Sarco Bucket Trap is used everywhere—on cookers, percolators, grease storage tanks and unit heaters. The savings in steam paid for the traps—the uniform, trouble-free production that resulted is an extra dividend.

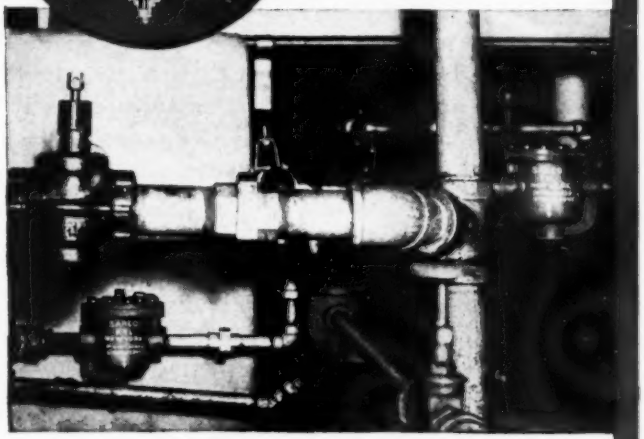
Perhaps a few inexpensive bucket steam traps would streamline your plant—or it may be that you need several different types of traps and temperature control. The Sarco Representative in your vicinity can select the combination of Sarco products that will give you best results at lowest cost.



*Sarco Bucket Trap on unit heater.*




*Sarco Bucket Traps on cooker and percolator.*



151

**SARCO** SAVES STEAM

**SARCO COMPANY, INC.**
*Represented in Principal Cities*
**475 FIFTH AVE., NEW YORK 17, N. Y.**
SARCO CANADA, LTD., TORONTO 1, ONTARIO

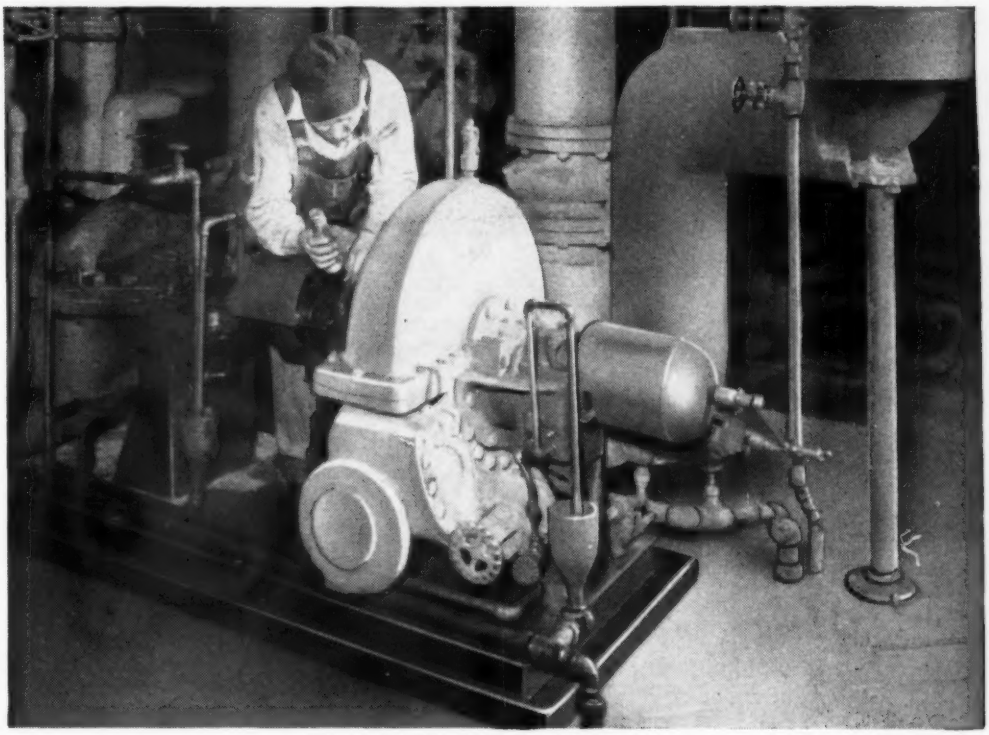
# It's G-E Turbine Drive...

## FOR SHORT SHIPMENT

**Yes, we mean it!** Delivery time on our standard, single-stage, shaft-governed turbine drives is approximately **15 weeks.** If you have an urgent replacement problem we can do better than that.

This fast shipment is possible because of the standardization of the basic single-stage line, applicable in general for ratings up to 800 hp. Delivery time of other units is longer depending upon engineering and manufacturing requirements.

## FOR LONG LIFE



"Operation and maintenance costs on this turbine have been negligible", reports the chief engineer of the Northeast Station, Kansas City Power and Light Company. On the job since 1941, the turbine has had over 30,000 hours of operation which, during the last two years, has been almost continuous, twenty-four hours a day, seven days a week.

The governor on this turbine controls pump discharge pressure in terms of load requirements on the system. To give maximum economy exhaust steam is used to heat the feed water.

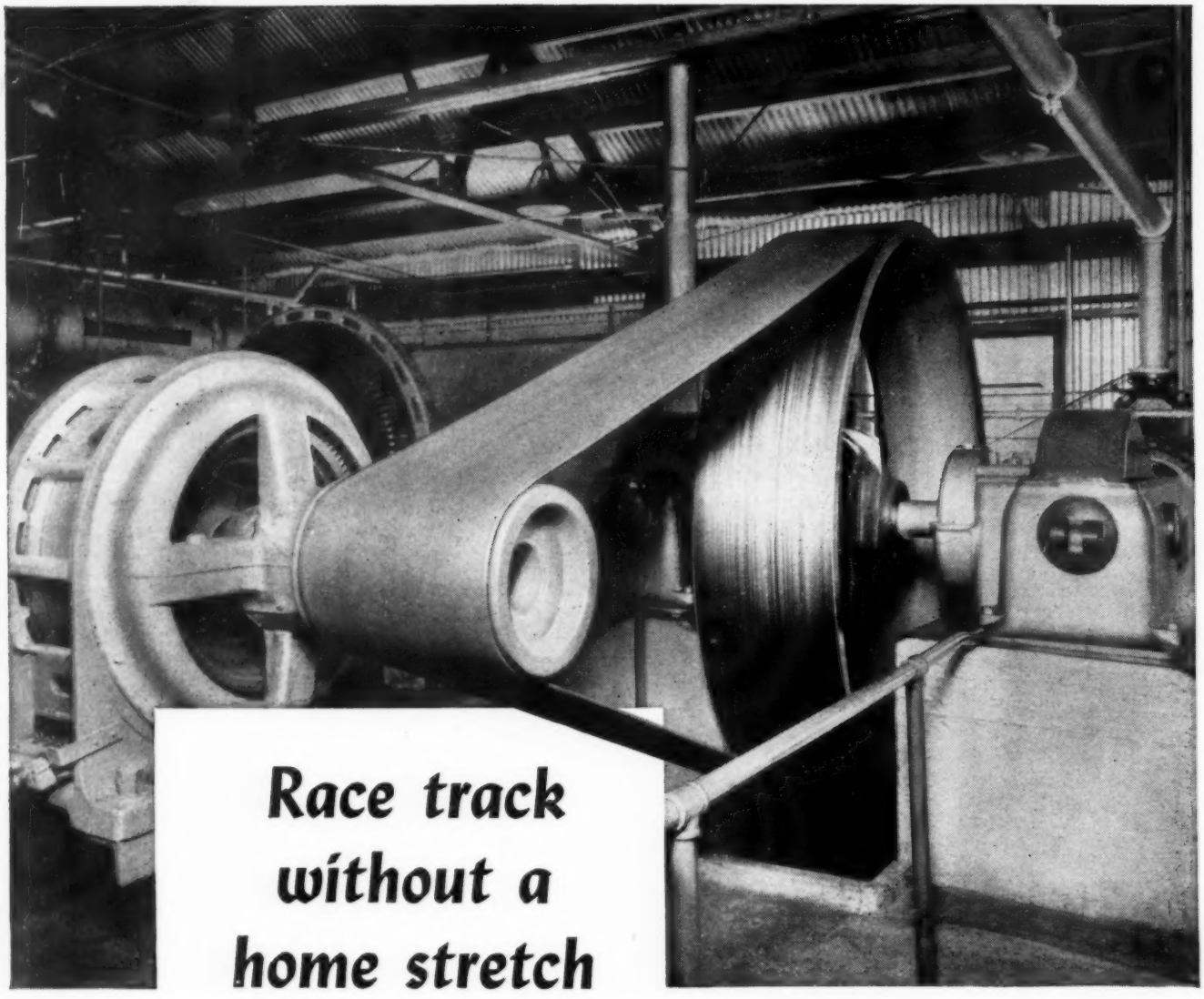
## FOR QUICK SERVICE

Servicing is simplified when you operate G-E turbine drive. Twenty-six service shops and 115 sales offices, at strategic locations throughout the nation, provide quick and convenient sources of aid for you.

For the assistance of G-E specialists in the application of turbine drives, get in touch with the nearest G-E Apparatus Sales Office, or write Apparatus Department, General Electric Company, Schenectady 5, N. Y.

**GENERAL ELECTRIC**

252-18



# Race track without a home stretch

Where horsepower is concerned, a transmission belt is something like a race track.

Send 400 horsepower through a transmission belt at 50 miles an hour. Right away those horses try to "go into the stretch."

Constant flexing tries to separate the belt's plies. Friction and heat try to ruin the carcass. Shock loads—with a force of several thousand pounds—try to pull the belt apart.

Some belts can't take it. They begin to stretch . . . to loosen and slip. The horsepower loses ground—and you lose money.

Hewitt-Robins engineers went to work to lick the problem. They found the answer in a very special kind of belting that lays as flat as the track at Churchill Downs.

It's a belt that won't slip or give when the heat is on . . . *a race track without a home stretch.*

It's Monarch Transmission Belting—"Job-Engineered" to withstand severe stresses and shock loads. Its extra-strong plies of cotton duck are imbedded in special-purpose rubber to give longer flexing life and freedom from stretch.

The belt resists moisture, mildew and grit . . . reduces operating costs by bringing *more power* from motor to main drive.

**Monarch Transmission Belting is one of many products "Job-Engineered" by Hewitt Rubber—including all types of industrial hose, belting and other rubber products.**

In fact, Hewitt brings you a total of 87 years of practical experience in "Job-Engineering."

Find out how Hewitt Rubber can help *you* conserve power and step up production. Write Hewitt Rubber Division, 240 Kensington Ave., Buffalo 5, N. Y. No obligation, of course!

HEWITT-ROBINS INCORPORATED

**HEWITT RUBBER**
**DIVISION**
HEWITT-ROBINS INCORPORATED
INDUSTRIAL HOSE • BELTING • PACKING

**Monarch Transmission Belting**

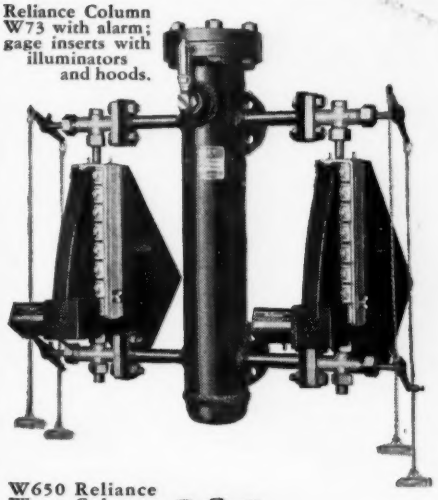
The code calls for:

**. . . two gage glasses on pressures over 400 psi**

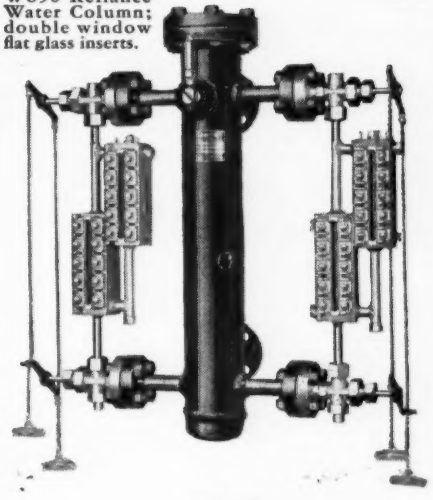
# Reliance *TWIN GAGE* Water Column Assemblies

**provide a simple and convenient means of complying with the code**

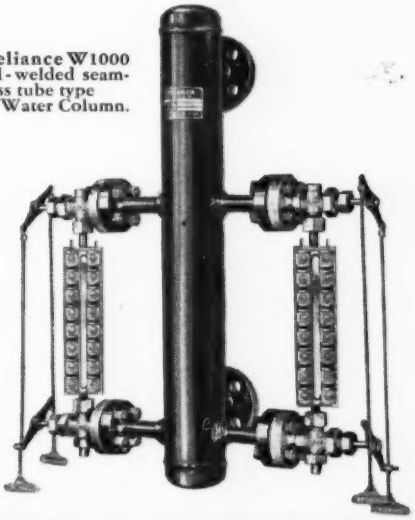
Reliance Column W73 with alarm; gage inserts with illuminators and hoods.



W650 Reliance Water Column; double window flat glass inserts.



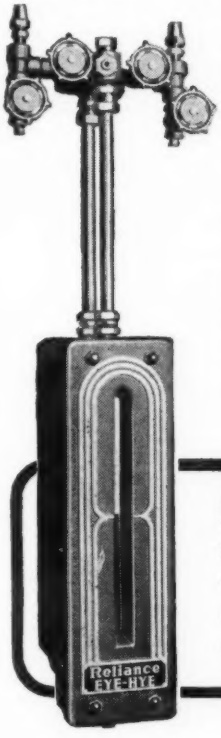
Reliance W1000 all-welded seamless tube type Water Column.



● You adhere to code requirements for maximum safety and efficiency in operating your power plant. It's up to you to select equipment that follows code procedure and gives you *the most satisfactory service.*

Probably the best practice in applying the rule for two gages on boilers operating at over 400 psi is by means of a *water column assembly.* This provides flexibility of placement, ease of providing mechanical support, greater stability of water level indication, provision of high and low alarm signal if desired (up to 900 psi), and over-all convenience and safety of operation.

"Single water column with two gages" is the most popular selection, according to Reliance experience. Principal water column manufacturer for 63 years, Reliance practice is to give you a wide margin of safety in rugged construction, fully approved welding procedure . . . and expertly custom-made equipment. Write for information on twin gage water columns.




**EYE-HYE Remote Reading Gage**

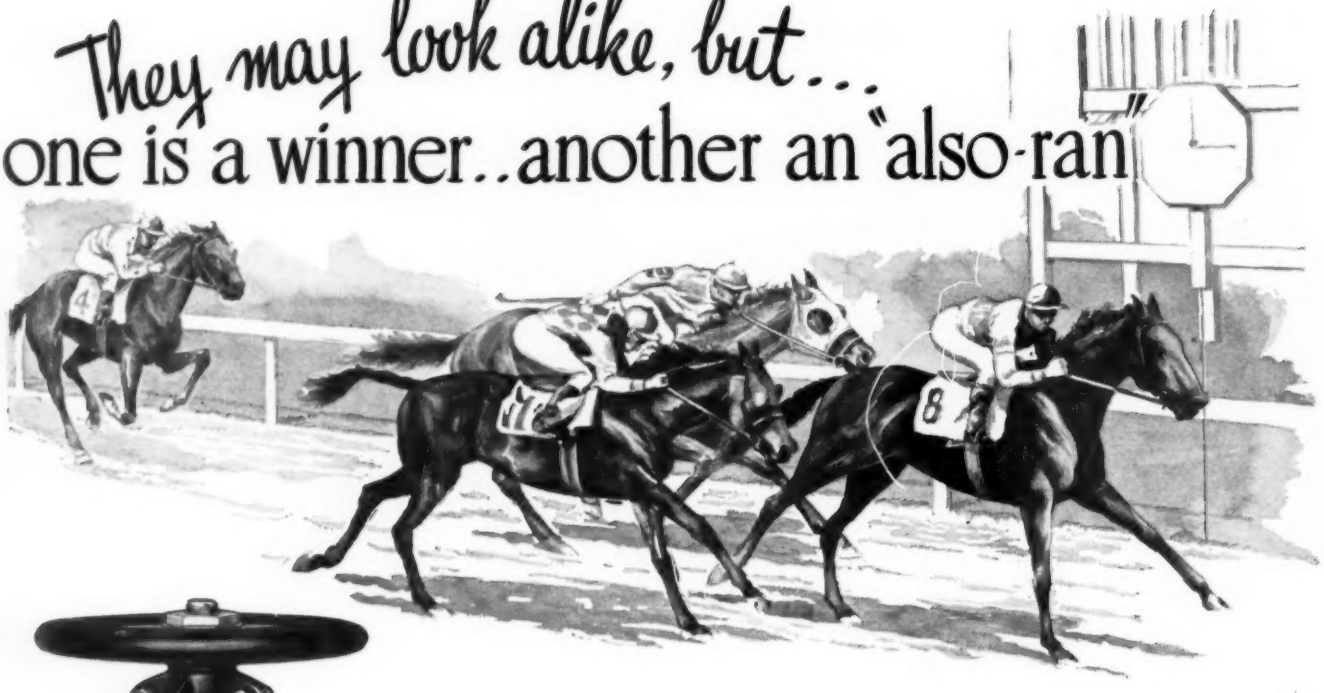
**is a "duplicate" gage that gives you accurate water level reading at convenient stations—on wall or instrument panel. Models for any pressure. More than 7000 in service.**

BOILER SAFETY DEVICES since 1884

# Reliance

THE RELIANCE GAUGE COLUMN CO. • 5902 CARNEGIE AVENUE • CLEVELAND 3, OHIO

# They may look alike, but...
# one is a winner..another an "also-ran"



Large Iron Body Bronze Mounted Gate Valve for 125 pounds W.S.P. Made in sizes 2" to 30", incl. Has flanged ends, outside screw rising stem, bolted flanged yoke and taper wedge solid disc. Taper wedge double discs can be provided in sizes 2" to 12", incl. Also available in All Iron.

Small size 200-pound Bronze Gate Valve, with screwed ends, inside screw rising stem, union bonnet and renewable, wear-resisting "Powellium" nickel-bronze seat rings and disc.

Call it "heart", "staying power", or what you will, some thoroughbreds have what it takes to win.

Now let's consider valves!

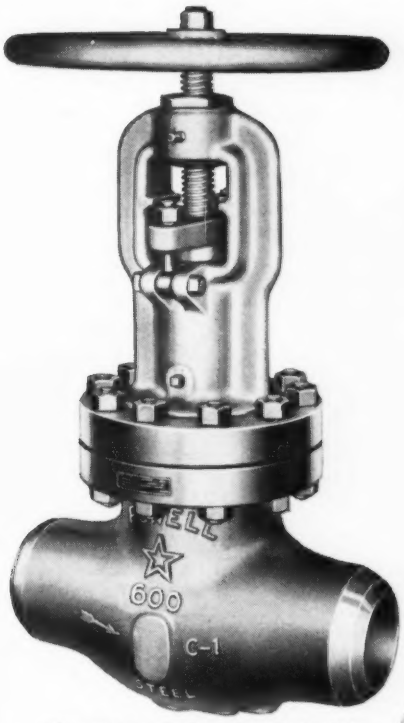
Compare the outward appearance of any Powell valve with that of other valves of the same type and size. You'll probably see very little difference, *It's the things you don't see that give Powell valves the "staying power" that makes them winners.*

There's nothing mysterious about these things. They're merely the result of the continual progress in design, knowledge of materials, and quality of workmanship that comes from more than a century of making valves —and valves only—for American industry.

**The Wm. Powell Company**
**Cincinnati 22, Ohio**
DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

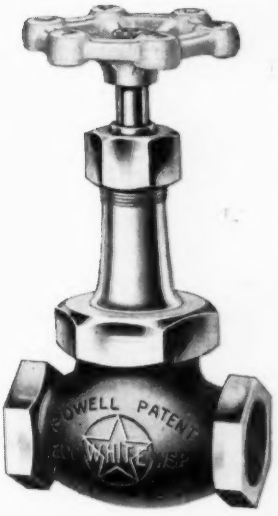
# POWELL

Class 1500-pound Cast Steel Welding End Gate Valve with POWELL PATENTED PRESSURE SEAL BONNET. The internal pressure seals body-bonnet joint. Anti-friction bearings in yoke.

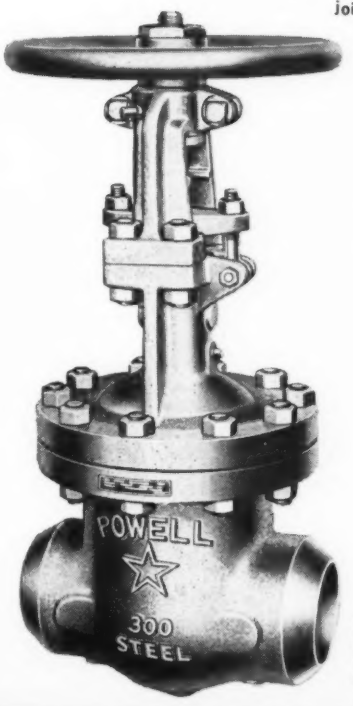



Class 600-pound Cast Steel Globe Valve with welding ends, outside screw rising stem and bolted flanged yoke.

Powell Cast Steel Valves of all types are available in pressure classes from 150 to 2500 pounds, inclusive.

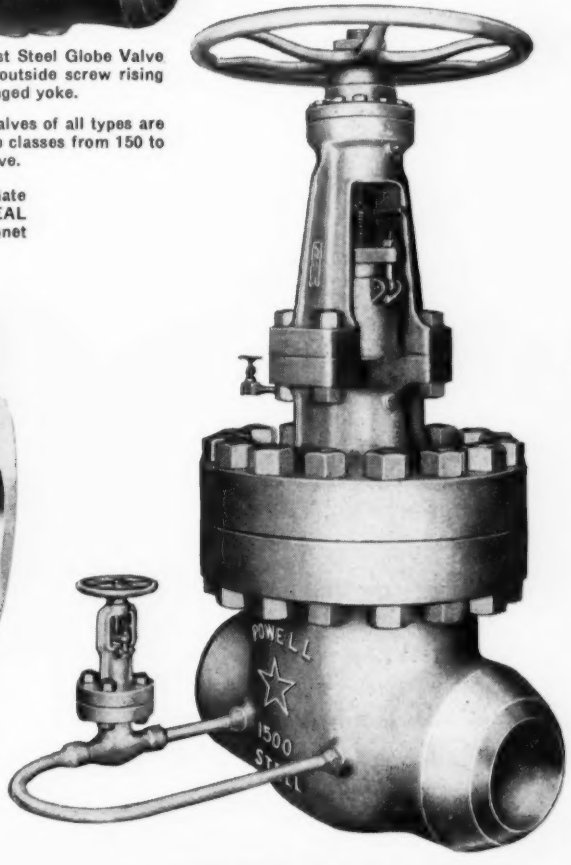



Small size 200-pound Bronze Globe Valve for steam, water, oil or gas. For assured long-life performance it has a renewable, specially heat treated stainless steel seat and regrindable, renewable, wear-resisting "Powellium" nickel-bronze plug type disc.




Class 300-pound Cast Steel Gate Valve with welding ends, bolted flanged yoke, outside screw rising stem and taper wedge solid disc.

125-pound Iron Body Bronze Mounted Swing Check Valve with flanged ends, bolted flanged cap and regrindable, renewable bronze seat and disc. Disc when wide open permits full, unobstructed flow through the valve body. Also available in All Iron.




Class 1500-pound Cast Steel Gate Valve, with welding ends, outside screw rising stem, bolted flanged yoke and welded by-pass.

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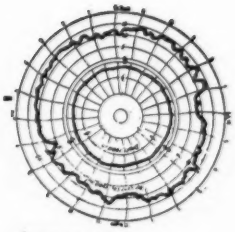
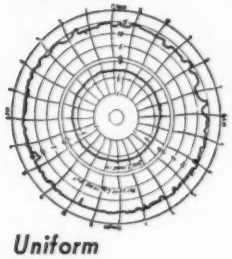


*Improper Crushing*



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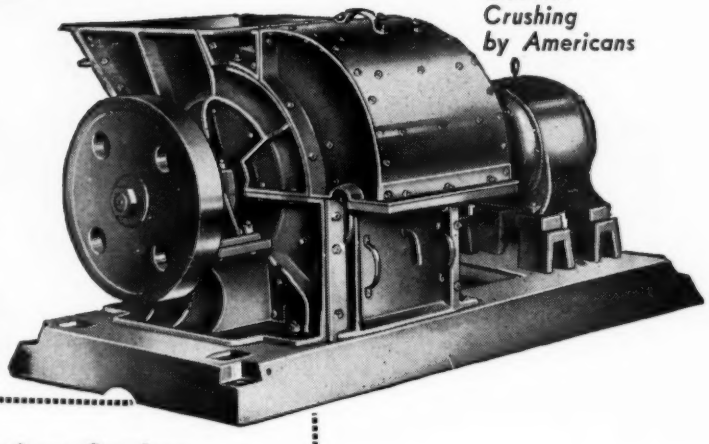

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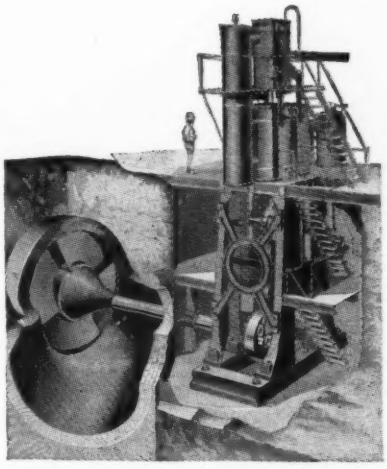

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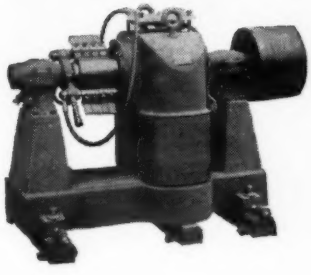

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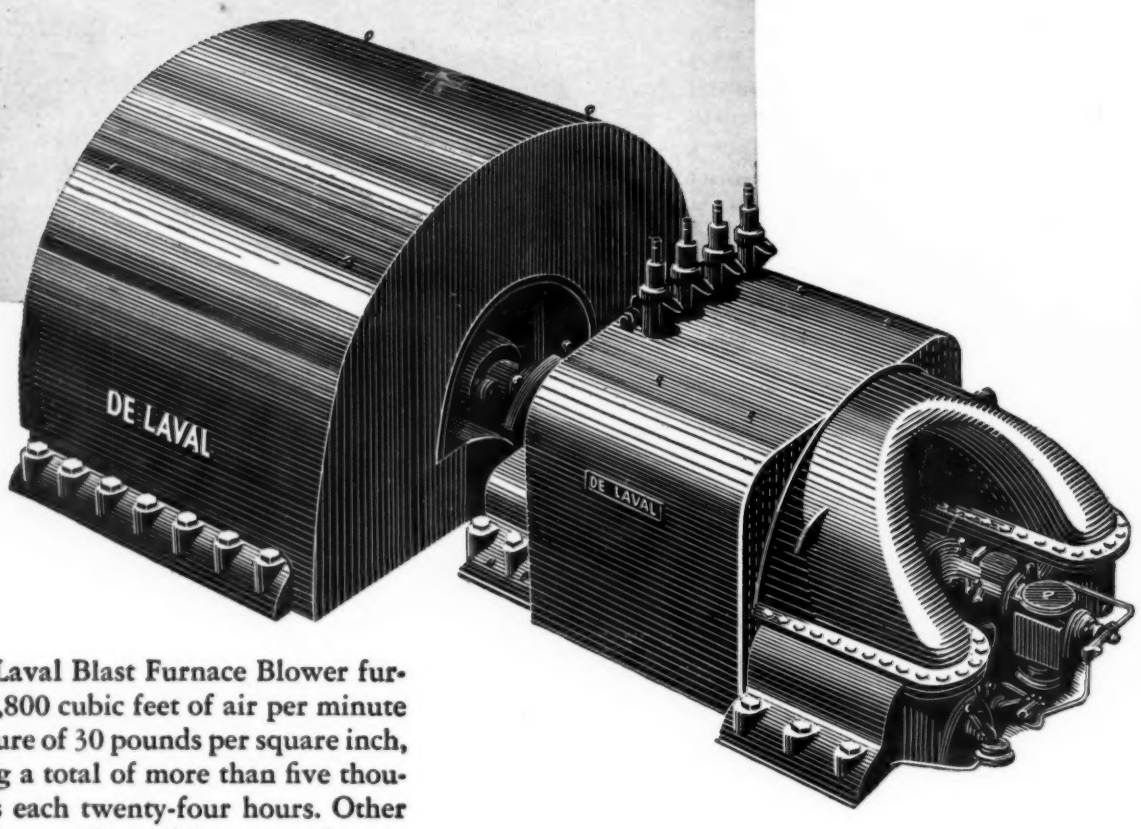


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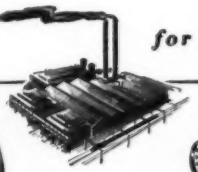
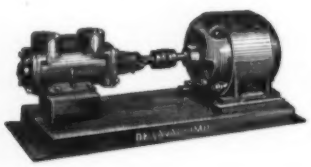
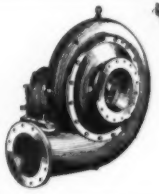
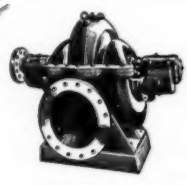
*De Laval*  *for Industry*

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## JULY 1947

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A CROSS-INDEX OF SUBJECTS FOR THE MONTH

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STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
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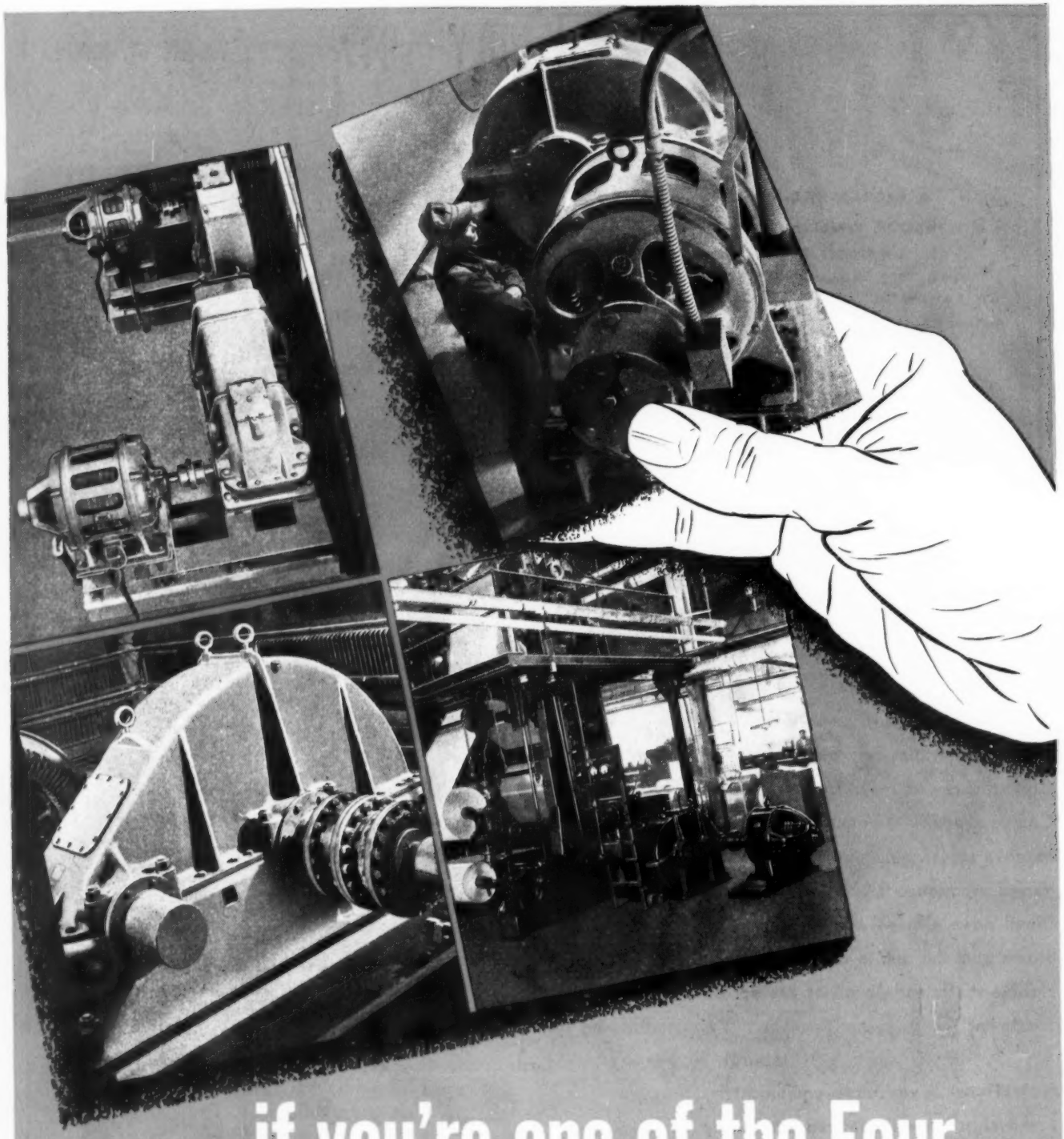

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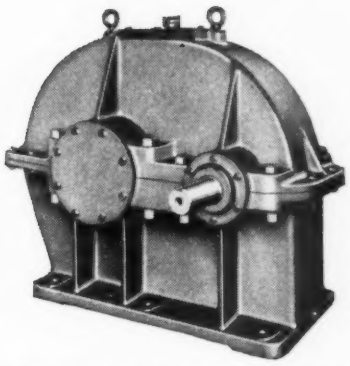

This Type SH speed reducer is a single-reduction unit which is furnished in thirteen standard ratios in each of twelve sizes. The Type DH speed reducer, which is a double-reduction unit, is offered in fifteen standard ratios in each of twelve sizes.

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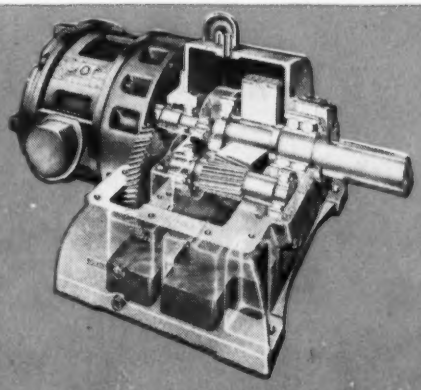

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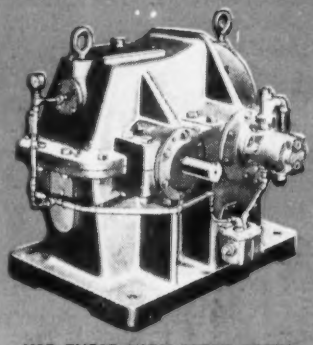

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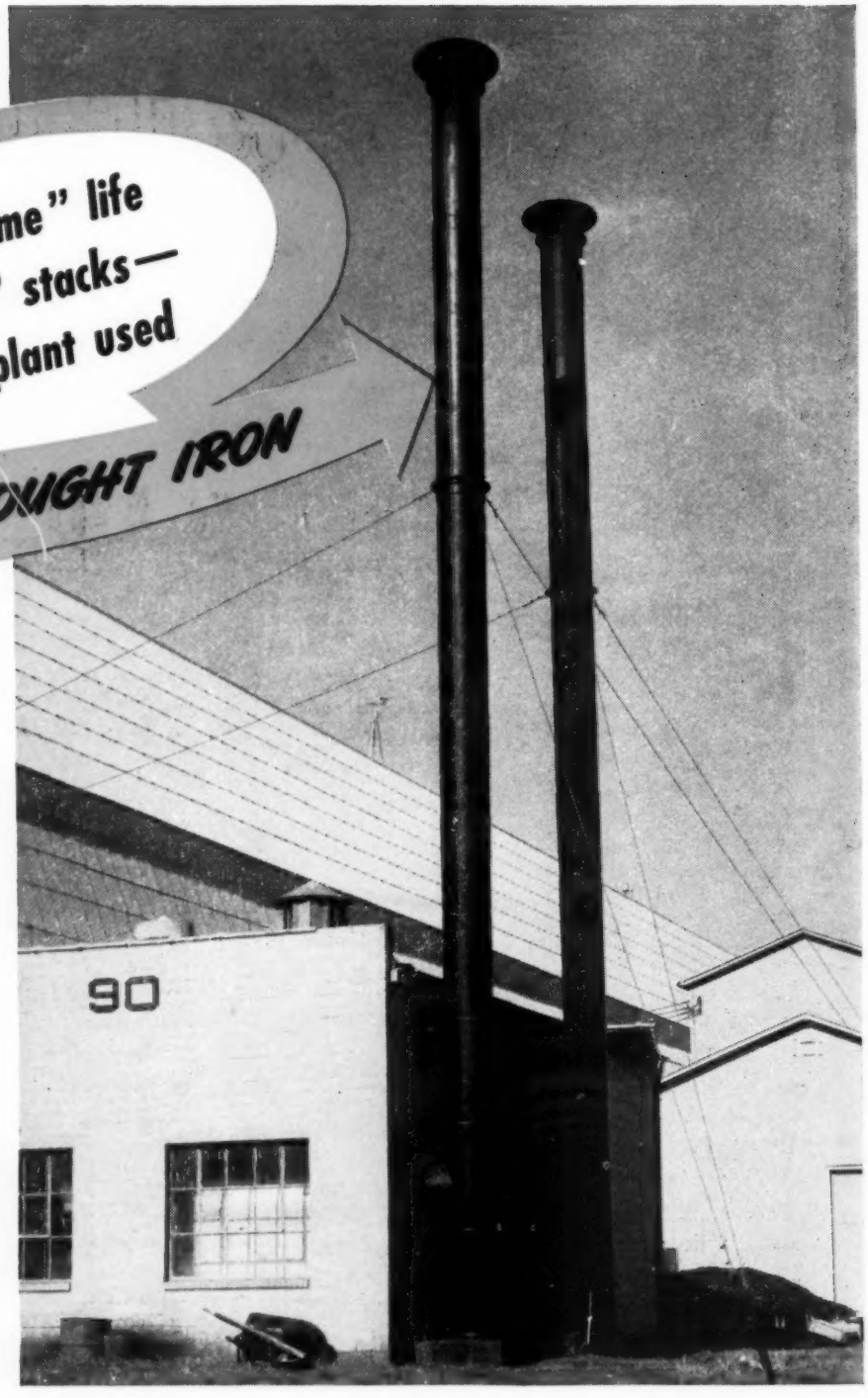
*4 out of 5 drives need speed reduction*

# For "full-time" life from "part-time" stacks— this plant used BYERS WROUGHT IRON




One of the most punishing conditions that a stack has to face is intermittent operation. Periods of idleness are generally more destructive than equal periods of use.

Three stacks at the Goodyear Aircraft Corporation at Wingfoot Lake, Akron, Ohio had such part-time jobs. Although capped, they failed in a relatively short time, and the engineers cast about for a more durable material. Byers wrought iron was used. Two of the new stacks, each 24-inches by 50-feet, are illustrated. They are fabricated from ¼-inch wrought iron plates and are welded throughout. Guy wire rings are formed from ⅜-inch wrought iron angles, cold bent to shape.

Under the best conditions, stacks must withstand severe corrosive attack. Carbon and sulfur compounds in the smoke will, if absorbed by moisture, form highly aggressive acids, that are extremely destructive to ordinary materials. Wrought iron has been very successfully used in this service. Its most impressive demonstrations have been made in installations where it was combined with low-first-cost materials, which permitted a direct comparison under identical conditions. In one such instance, a four to one life ratio was registered by wrought iron. Reports of two and three times as much service from wrought iron as from ordinary materials are common.

The reason for wrought iron's excellent service is found in its unique composition and structure. Tiny fibers of glass-like silicate slag, threaded through a body of high purity iron, halt and "detour" corrosive attack. This discourages pitting and rapid penetration. The fibers also help anchor the initial protective scale, which shields the underlying metal.

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POWER

PHILIP W SWAIN, EDITOR • JULY 1947 • ESTABLISHED IN 1882

# CLEAN AIR—

# THE ENGINEER'S WAY

AIR POLLUTION is like sin—practically everybody is "agin it." No one likes to breathe air laden with smoke, dust and fumes, to live in surroundings begrimed with soot, to view the countryside through a haze of "smog." All of which makes crusading for clean air politically attractive and perennially popular. Small cause for wonder then that it has been a football of sincere but ill-informed laymen and aspirants for public office, against whose clamor the voice of the engineer has been but a whisper.

The blame for this dangerous state of affairs rests as much with us, the power engineers, as with the pressure groups. All too often we have failed to realize and accept our twofold responsibility: (1) to make sure that our own plants are not polluting the atmosphere, and (2) to bring our technical knowledge actively into community thinking. If we continue to stand on the sidelines both we and our communities will suffer, and the penalties may be heavy.

Justifiably or not, power plants offer shining targets and power engineers make excellent scapegoats. Put cold-bloodedly, our first choice is simple—Do we prefer to put our own houses in order, or will we wait until someone else tells us how to do it in a way that we won't like?

But there's more to this than protecting our own interests. Compared to the job of cleaning up any individual stack, the job of cleaning up a community is infinitely complex and full of pitfalls for the technically unwary. Therein lies the greatest danger—lawmakers, uninhibited by the engineer's caution, may deal a body blow to true progress by passing ordinances dictated by enthusiasm rather than knowledge.

Here is a job for every power engineer, a responsibility none of us can afford to ignore. For it we need to know more about every phase: What causes smoke and dust? How can they be eliminated by better operating methods, improved equipment and proper fuel selection? Where trouble cannot be avoided at the source, how can pollution be kept from reaching the air? How should pollution be measured? What is the effect of weather?

As its contribution, POWER begins in this issue, on page 64, a series aimed to review every part of the air-pollution problem, so that its readers may be armed with the latest and best data available. Because we sincerely believe that the fight for clean air begins at home, the initial articles, after a brief statement of the general problem, deal with the practical steps to insure a clean stack for your plant. Later articles will give you the information needed to play an intelligent part in your community's clean-air program. Read them, study them, put them to work in your plant and your community. Let's win the air-pollution battle the engineer's way!

# CLEAN STACKS-[illegible]-A JOB

## WHY?

**Something will be done about air pollution. For our own benefit and that of our fellows, it had better be right!**

## HOW?

**1 By licking our own stack-discharge problems**

**2 By putting our know-how to work in our communities**

**3 By continuing the search for answers to the "unknowns" in air-pollution prevention**

*From a painting by Peter Helck, courtesy The Dow Chemical Co*

► TAKING A SERIOUS LOOK at the air-pollution problem, the practical engineer is apt to ask, "When we have the technical savvy to clean up almost any individual stack-discharge problem, what makes it so tough to clean up a community? Digging out the answers to that question is as good a way as any to tackle the whole matter of air pollution and the engineer's part in it.

To begin with, finding out if your own plant is an offender is relatively easy. Often it just means stepping outside and looking up. Tests and measurements may be required sometimes, but it is probably safe to say that if a stack discharges smoke or dust the engineer in charge knows it. Locating the cause may take some time and trouble, but normally only basic engineering know-how is needed.

With the cause known, the same normal engineering savvy prescribes remedies. Sometimes nothing more than substituting good operation for slipshod is needed, and eliminating the nuisance pays dividends in higher efficiency. In other plants, changes or additions are necessary. Their cost can be figured accurately and it becomes fairly easy to weigh the cost against the company's ability to pay. Knowing all the facts, the management can buy the amount of pollution elimination that is economically justified.

Naturally, it isn't always duck soup. Some plants present tougher problems than others. But the important fact is that by following familiar engineering procedures we can, in the individual plant, determine if a nuisance exists, locate its cause and find the cure. Most important of all, we can compare cost of elimination with benefits obtained.

When a community starts to clean up, the sane engineering approach found in the individual plant usually disappears, and emotion replaces judgment. How much commotion develops depends on how tough conditions have been and how sorely the citizens' patience has been tried. Led by civic organizations, women's clubs and the inevitable politicians, the drive begins and continues in an atmosphere of hysteria. Out of it comes legislation, all too often hasty and ill-considered. Nevertheless, it is enforced while the first flush of enthusiasm lasts. Sooner or later, though, an economy-minded administration cuts the appropriation

# FOR THE POWER ENGINEER

By L N ROWLEY, *Managing Editor* and J C McCABE, *Assistant Editor*

and the pollution-prevention program dies of financial malnutrition. Many of us have seen such abortive campaigns.

The histories of this country and the older nations of Europe reveal countless repetitions of this cycle. H F Hebley*, widely recognized authority on influence of weather upon atmospheric pollution, quotes a commission studying the question in London in 1307: " . . . to inquire of all such who burn sea coal in the city, or parts adjoining, and to punish them for the first offence with great fines and ransoms, and upon second offence to demolish the furnace." Now, 600 years later, London still has a smoke problem.

The difficulty in cleaning up a community's air largely grows out of the bitter fact that the cooperation of all concerned cannot be assured and some must be coerced. This necessity requires a law, and enforcement, which, in turn, means: (1) knowing the extent and causes of the problem (2) determining to what degree it can be solved and what it will cost individuals and the community in comparison with the benefits obtained (3) setting up performance standards and (4) devising means to detect failures to meet these standards. To the trained engineer, both the difficulties of these four steps and the dangers of overlooking or skimping them are obvious.

Right at the beginning, the weather interjects a big question mark. With a brisk wind blowing we're not apt to be conscious of smoke or smog, but the same amount of pollution, discharged on a "heavy" day gives us the "night at noon" sort of conditions the newspaper photographers love. Which is representative of the problem? Even if the influence of atmospheric conditions can be allowed for, and we can gain some idea of the size of the pollution task we're tackling, how do we find out what causes it? Are the railroads at fault? Do domestic furnaces make most of the smoke? What is heavy industry contributing to the dust loading? The hard truth is, as engineers know, that we simply do not yet have the means for accurately determining the causes of pollution.

With some exceptions, it can be said that a community can have as much pollution-prevention as individuals and the community are willing to buy. Sounds sensible, doesn't it? Yet lack of appreciation of the economic factor lies at the bottom of many past clean-up failures and will defeat many new programs.

This business of cost comes up at many points and in many guises. For example, open-hearth furnaces necessarily operate with a reducing atmosphere and hence smoke. They could be cleaned up by some form of after-furnace to "burn" the smoke, but higher cost for finished steel is the price. In some communities, where domestic fuel burning has come in for a large share of the blame, solutions have been sought in so-called "smokeless" fuels, which can be handled in often faulty residential heating apparatus. Such fuels are usually relatively expensive, which means a material increase in a major item of low-income budgets.

Are such costs justified? No one can say, in general. *The important point is that costs should be known and considered before any ordinance is written.* Like it or not, the ordinance defines the amount of pollution-prevention the community is seeking. Unfortunately it doesn't carry a price tag.

A smoke ordinance is just another law unless it can be enforced. This means stating requirements clearly and providing means for detecting violations. For both, we need means of measuring pollution. While we have a number of methods in use today, they are either dependent on the vagaries of the observer and the conditions under which he works, or hopelessly complex and expensive. Lack of realistic appreciation of these weaknesses hamstrings many community programs.

Does all this mean that nothing can be done to bring clean air to our cities and towns? No, but it does mean that we must substitute the engineering approach for the 3-ring circus that is pollution-prevention as it is usually practiced. And this is a job that we, as power engineers, must tackle. A job this series in POWER plans to point up. First, since any community nuisance is but the sum of many individual nuisances, we can begin by making sure our own stacks are clean. Second, as individual citizens and as members of engineering societies, we can contribute our know-how to the devising of pollution-prevention programs that will really work because they make realistic allowance for the hard fact that we don't yet know all the answers. Finally, we can continue the search for the knowledge that will eventually win a complete victory over air pollution.

* *Engineering Surveys of the Atmospheric Pollution of Cities*, by Henry F. Hebley

# Match Your Motor to The Driven Machine

**Select your motor to have an efficient speed, economical coupling, highest over-all efficiency. Carl Bauman, chief electrical engineer, American Cyanamid Co, outlines the factors to consider in getting the best motor to fit the driven load**

▶ WHEN BUYING A MOTOR to match the driven machine remember that motor costs vary inversely with rated speed, that is, the higher the speed the lower the relative cost. Low-speed motors have lower efficiency and power factor than equivalent high-speed motors. For machines operating below 720 rpm it may be more economical to select a high-speed motor to drive the load through a suitable belt, gear or chain drive. Most motor manufacturers make a complete line of gear motors up to 75 hp for very slow speed applications.

**Motor Coupling.** Whenever possible on high-speed applications couple the motor directly to the machine it drives. This is more economical since indirect coupling devices like chains, gear or belts absorb power and result in decreased over-all efficiency. Before making a selection, compare the long-term higher efficiency and greater initial cost of indirect drives with the first cost and lower operating efficiency of a low-speed direct-coupled motor.

There is no limit to the maximum motor size that can be directly coupled to its load. Here are upper size limits of motors that drive their loads indirectly: Belt-connected motors are limited to about 40 hp at 1800 rpm and range up to a maximum of 150 hp at 450 rpm for 2-bearing motors. V-belt driven motor range from 60 to 250 hp at the same speeds. Chain-driven-motor limits range from a maximum of 5 hp at 1800 rpm to 75 hp at 720 rpm.

**Operating Position.** The position in which the motor is to operate should also be given consideration. Most horizontal ball-bearing motors can also operate in a vertical position, but the application should be checked for unusual thrusts that may require a special bearing.

Direction of rotation need not be considered when specifying a motor except on those having an integral cooling fan. Fans in inclosed motors of larger frame size are designed to operate in only one direction. Thus it is best to specify direction of rotation for motors of 40 hp and up.

Standard open motors are available with both sleeve and ball bearings, with a small premium on the ball-bearing machines. Totally inclosed units are manufactured with ball bearings only unless special bearings are necessary. Sleeve bearings were built into 200-hp 3600-rpm totally inclosed fan-cooled motors for one chemical plant when it was found that ball bearings would not stand up under the load. Normally it is not necessary to specify limits on end play or degree of dynamic balance. These features, however, become important in some precision-tool applications, as high-speed grinders.

Standard motors are designed to operate in an ambient temperature of 40 C, maximum. AIEE standards permit a maximum temperature rise above this by an amount that depends on the kind of insulation used and the type of motor inclosure. If maximum ambient temperature does not exceed this limit, standard class *A* insulation can be specified. If exceeded, class *B* insulation should be requested.

**Use Standard Motor.** Conditions surrounding the motor site affect the type of inclosure needed. Where possible, use the standard open motor because, all things being equal, it is the cheapest. In addition, the open motor has an inherent overload capacity because it has a continuous rating of 40 C over maximum ambient: With a service factor of 1.15 it can be overloaded 15%

**Fig. 1—Two 5-hp motors connected through variable-speed drives to positive displacement pumps. Motors operate at an economical speed on adjustable loads**

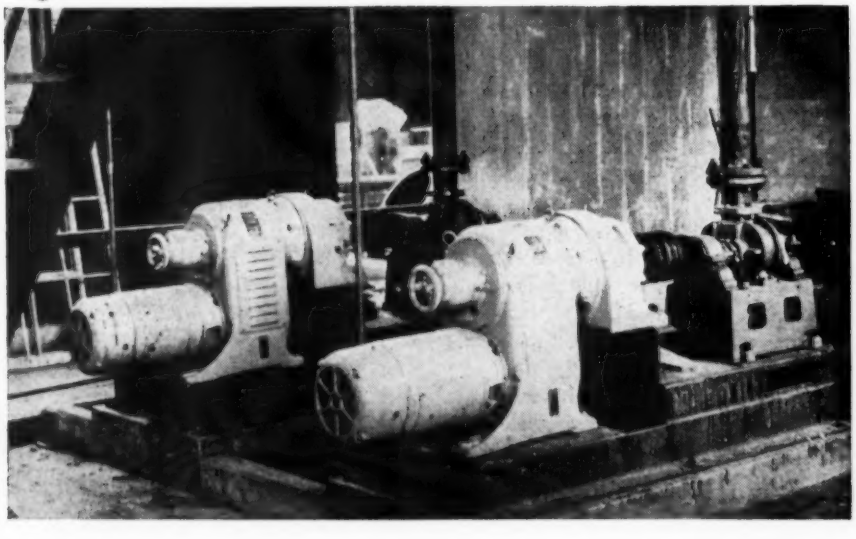


**Fig. 2—Totally inclosed fan-cooled motor driving an outdoor rotary kiln**

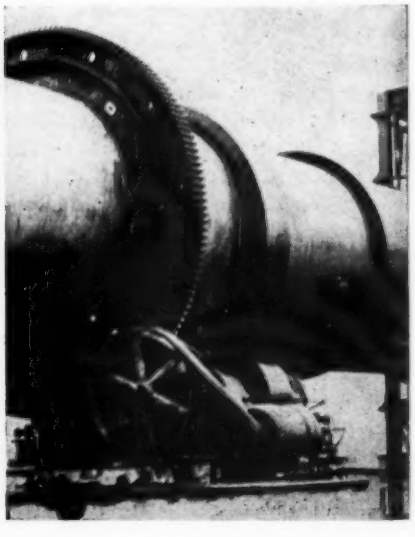
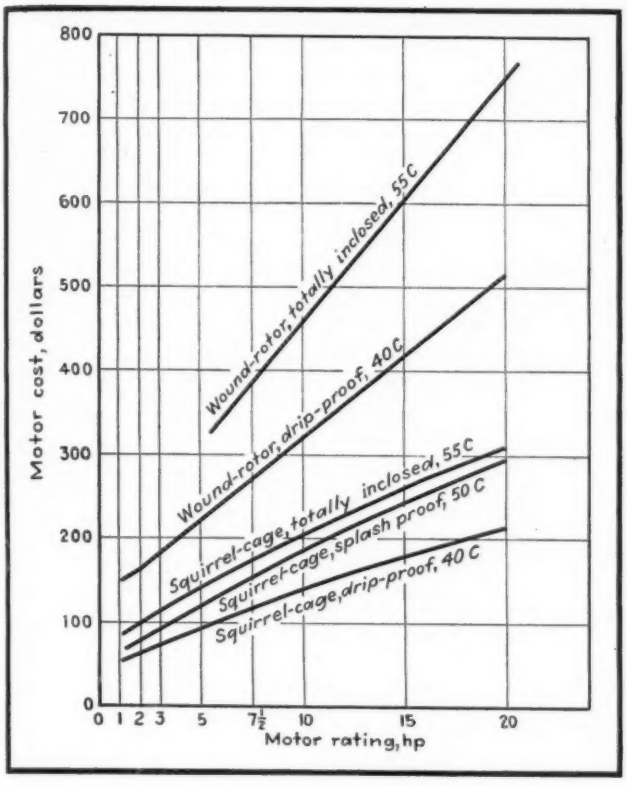


Fig. 3—Relative costs of squirrel-cage and wound-rotor induction, 4-pole, 1800-rpm motors rated from 1 to 20 hp



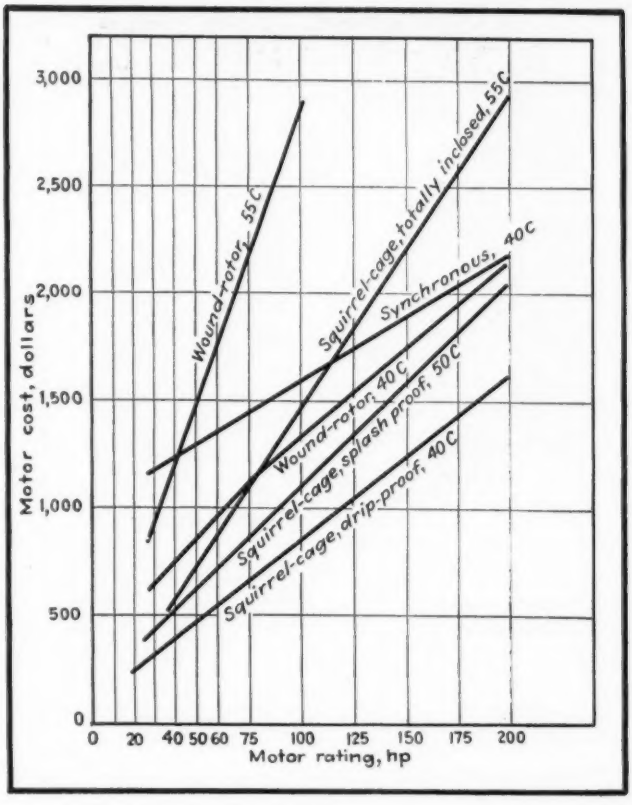



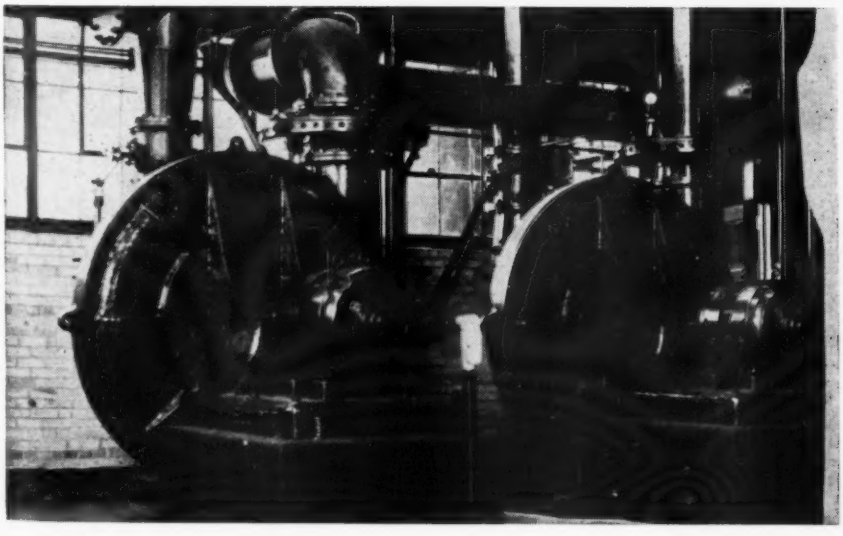

Fig. 4—Relative costs of 1800-rpm squirrel-cage, wound-rotor induction and synchronous motors from 20 to 200 hp

continuously without exceeding the maximum 55 C rise. Manufacturers are standardizing on drip-proof construction for standard open motors at no extra cost, which permits their use where drips occur.

Splash-proof motors, which have a temperature rating of 50 C, are designed for outdoor applications or where frequent hosing or wetting prevents the use of open units. The former may be overloaded about 5% provided the temperature rise by thermometer does not exceed 55 C.

Totally inclosed motors are rated up to the maximum rise (55 C) for class *A* insulation and can be used in dusty, gaseous or corrosive atmospheres. They have become almost standard for the chemical and petroleum industries. For the chemical industry, the windings are given extra dips in acid-resisting varnish. These motors are available for all hazardous locations as defined and classified in the *National Electrical Code*, chap 5, art 500.

Fig. 5—Totally inclosed high-speed motors direct-connected to sulphur dioxide blowers. Motors have windings specially treated with acid-resisting varnish



**Motor Costs.** Fig. 3 shows costs of squirrel-cage and wound-rotor 1800-rpm motors up to 20 hp. Fig. 4 shows costs of 1800-rpm squirrel-cage wound-rotor and synchronous motors from 20 to 200 hp. Costs of motors at 3600, 1200 and 900 rpm are found by reading 1800-rpm motor cost from Fig. 3 and 4, and multiplying it by conversion factor of the table on page 68. The curves give average list prices. They are within 10% of actual prices, which is near enough for estimating purposes.

Altitude causes derating of motor output, starting at about 3300 ft above sea level. Because of the rarefied air, motor temperatures rises about 1% for each increase of 330 ft above 3300. Take this into account if motors are to operate in mountainous districts.

The voltage specified has a direct bearing on economy of motor operation, but in most plants there is little choice since the voltage must be that available on the plant bus. There is some choice

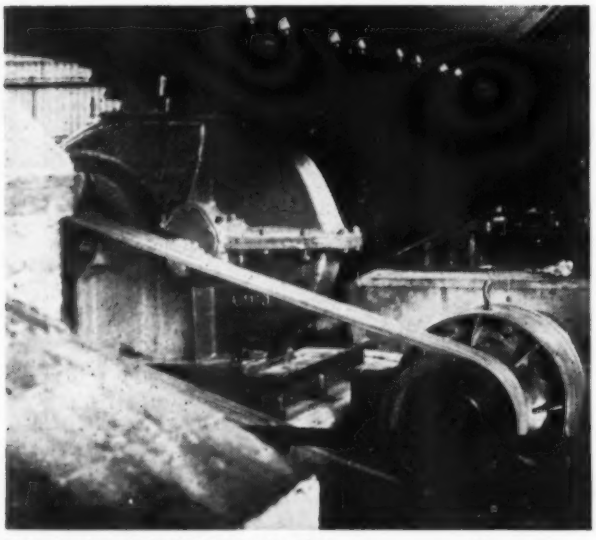


Fig. 6—This high-torque low-starting-current motor is connected through a belt and reducing gear to drive a sludge drier in a chemical plant

*Photos, courtesy of Chemical Construction Corp*

in small motor sizes of single-phase 110/230-v or 3-phase 220/440-v.

Modern practice leans more and more toward 440-v 3-phase as a standard for motors under about 150 hp. With 220-v systems this upper limit should not go much above 75 hp. Experience shows that 3-phase 440-v electrical systems for motors of ⅓ hp and larger aid plant load balance. This results in improved over-all power factor, efficiency and decreased investment in distribution copper. It is often more economical to consider some higher voltage such as 2300 for motors over 150 hp.

Whatever voltage is available at the plant bus must be carefully studied to determine what it actually will be at the motor terminals. Best results are obtained if motor terminal voltage exactly matches the nameplate voltage. Since torque varies as the square of the voltage, low voltage can seriously affect starting and running torques. Current and temperature are also higher.

**Consider Starting Current.** Before completing motor specifications for a plant using purchased power consider the power company's regulations on the maximum allowable current inrush during the starting period. Most utilities limit this inrush to some multiple of the motor full-load current, based on the total connected plant horsepower. This condition can be frequently complied with in small motors by purchasing low starting-current motors for starting on full voltage.

In the larger motor sizes (10 hp and larger) the inrush current is limited by employing some standard method of reduced-voltage starting. It is important to check the starting torque, on the lowest voltage tap required to limit the inrush to an accepted value.

Ever since 1940, *National Electrical Code*, chapter 9, paragraph 94, 304 has required that manufacturers designate, by a code letter on the motor nameplate, the locked rotor kva per hp at full voltage. This makes motor choice easier and helps in selection of control to limit the starting kva.

All power required to drive the machine plus that which goes to make up the losses of both machine and motor will flow through the motor. In the best designed system, losses will be the lowest possible for the given conditions. Rates are not only based on energy consumed but on wattless kva resulting from low power factor as well. More and more electric utilities have adopted some power-factor penalty clause, usually penalizing consumers for values under 90%. This puts low power factor at a premium. If over-all plant power factor is low it often proves economical to select a synchronous motor where a simple low-cost induction motor could have been applied just as correctly. In a comparatively few years, special applications like these pay for themselves in reduced penalties.

## CONVERSION FACTORS AS PERCENT OF 4-POLE MOTOR PRICE

Percent of Price

| Motor Size | *Squirrel-cage motor Normal torque, low current* | | | | | | | | | *Squirrel-cage motor High torque, low current* | | | | | | | | | *Wound-rotor motor* | | | | | | | | | *Synchronous motor* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 40 C | | | 50 C | | | 55 C | | | 40 C | | | 50 C | | | 55 C | | | 40 C | | | 50 C | | | 55 C | | | 40 C | | |
| | No. poles: | | | No. poles: | | | No. poles: | | | No. poles: | | | No. poles: | | | No. poles: | | | No. poles: | | | No. poles: | | | No. poles: | | | No. poles: | | |
| | 2 | 6 | 8 | 2 | 6 | 8 | 2 | 6 | 8 | 2 | 6 | 8 | 2 | 6 | 8 | 2 | 6 | 8 | 2 | 6 | 8 | 2 | 6 | 8 | 2 | 6 | 8 | 6 | 8 | 10 |
| 1 | — | 117 | 159 | — | 115 | 154 | — | 117 | 135 | — | — | — | — | — | — | — | — | — | — | 107 | 126 | — | — | — | — | — | — | — | — | — |
| 1½ | 103 | 115 | 160 | 103 | 117 | 163 | 116 | 111 | 138 | — | — | — | — | — | — | — | — | — | — | 116 | 135 | — | — | — | — | — | — | — | — | — |
| 2 | 104 | 111 | 161 | 100 | 110 | 157 | 94 | 106 | 145 | — | — | — | — | — | — | — | — | — | — | 119 | 142 | — | — | — | — | — | — | — | — | — |
| 3 | 105 | 119 | 164 | 104 | 122 | 166 | 104 | 120 | 165 | — | — | — | — | — | — | — | — | — | — | 121 | 143 | — | — | — | — | — | — | — | — | — |
| 5 | 104 | 130 | 175 | 99 | 130 | 189 | 98 | 134 | 181 | — | 130 | 174 | — | — | — | — | 133 | 180 | — | 121 | 145 | — | — | — | — | — | — | — | — | — |
| 7½ | 105 | 128 | 160 | 101 | 140 | 167 | 98 | 131 | 153 | — | 128 | 160 | — | — | — | — | 131 | 154 | — | 122 | 146 | — | — | — | — | 127 | 144 | — | — | — |
| 10 | 105 | 120 | 158 | 92 | 115 | 167 | 97 | 113 | 153 | — | 119 | 161 | — | — | — | — | 113 | 156 | — | 119 | 148 | — | — | — | — | 113 | 148 | — | — | — |
| 15 | 105 | 132 | 161 | 108 | 146 | 169 | 103 | 132 | 153 | — | 135 | 165 | — | — | — | — | 138 | 168 | — | 108 | 132 | — | — | — | — | 118 | 148 | — | — | — |
| 20 | 105 | 135 | 159 | 89 | 125 | 153 | 94 | 131 | 155 | — | 136 | 160 | — | — | — | — | 131 | 155 | — | 109 | 129 | — | — | — | — | 115 | — | — | — | — |
| 25 | 105 | 138 | 158 | 104 | 138 | 153 | 104 | 140 | 161 | — | 138 | 158 | — | — | — | — | 139 | 161 | — | 110 | 127 | — | — | — | — | — | — | — | — | — |
| 30 | 105 | 115 | 143 | 104 | 120 | 154 | 104 | 121 | 151 | — | 115 | 153 | — | — | — | — | 121 | 158 | — | 110 | 127 | — | — | — | — | — | — | 61 | 70 | 82 |
| 40 | 105 | 119 | 137 | 97 | 123 | 137 | 104 | 126 | 161 | — | 127 | 147 | — | — | — | — | 132 | 166 | — | 109 | 123 | — | — | — | — | — | — | 61 | 71 | 83 |
| 50 | 105 | 110 | 130 | 104 | 116 | 140 | 103 | 125 | 135 | — | 118 | 139 | — | — | — | — | 120 | 142 | — | 109 | 123 | — | — | — | — | 109 | 122 | 62 | 72 | 84 |
| 60 | 105 | 112 | 129 | 97 | 116 | 129 | 104 | 115 | 151 | — | 112 | 129 | — | — | — | — | 115 | 150 | — | 110 | 120 | — | — | — | — | — | — | 64 | 73 | 84 |
| 75 | 115 | 114 | 129 | 112 | 117 | 133 | 109 | 123 | 132 | — | 114 | 129 | — | — | — | — | 122 | 131 | — | 110 | 118 | — | — | — | — | 110 | — | 67 | 75 | 85 |
| 100 | 125 | 117 | 124 | 115 | 120 | 126 | 116 | 115 | 139 | — | 117 | 124 | — | — | — | — | 110 | 132 | — | 111 | 114 | — | — | — | — | — | — | 70 | 77 | 85 |
| 125 | 130 | 117 | 131 | 125 | 123 | 139 | 117 | 120 | 135 | — | 117 | 131 | — | — | — | — | 117 | 131 | — | 112 | 123 | — | — | — | — | — | — | 71 | 77 | 86 |
| 150 | 130 | 117 | 131 | 111 | 117 | 131 | 117 | 117 | 131 | — | 117 | 131 | — | — | — | — | 117 | 131 | — | 113 | 122 | — | — | — | — | — | — | 75 | 81 | 88 |
| 200 | 130 | 120 | 129 | 126 | 120 | 130 | 117 | 120 | 129 | — | 120 | 130 | — | — | — | — | 120 | 130 | — | 108 | 118 | — | — | — | — | — | — | — | — | — |

Multiplier for 2-, 6- and 8-pole motor price as % of 4-pole price of same size and type taken from curves in Fig. 3 and 4.

# How To Select and Install Pyrometer Leadwires

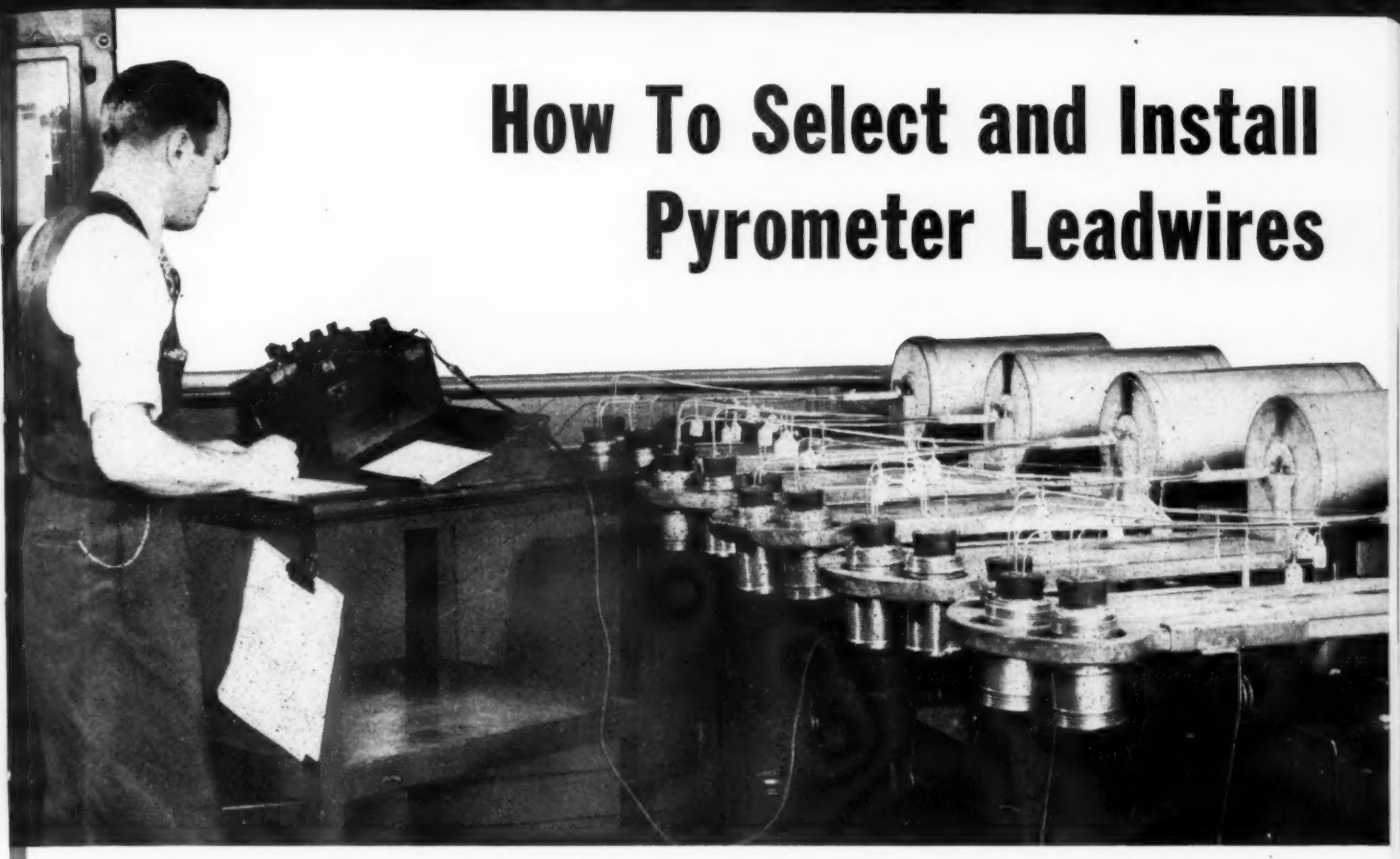


Fig. 1—The samples of wires, whose ends are welded into thermocouples, protrude from the cylindrical furnaces which are shown at the right in the photograph. The opposite ends are inserted in ice water during the test

**If you use the proper wire and adhere to a few simple rules when installing extensions, accurate measurement and control are assured, as well as savings on maintenance and on repairs**

By C C ROBERTS AND C A VOGELSANG *Brown Instrument Co Division*

► IN PYROMETRY, temperature indication is obtained by measuring voltage generated by temperature difference between hot and cold junctions of a thermocouple. If the thermo-electric circuit is confined to the thermocouple proper, temperature variations at the cold junction (terminal) can introduce an intolerable error. But when suitable leadwires are used to extend the thermocouple terminals to the indicating instrument, and thus locate the cold junction at a point where changes in its temperature can be easily and accurately compensated, the degree of precision can be considerable. The leadwires become part of the thermoelectric circuit, and the thermocouple actually consists of the extension plus the thermocouple itself. Hence, the thermoelectric characteristics of the wires are as vital as those of the thermocouple proper.

All experienced users appreciate the importance of providing protection for the thermocouple proper. Proper protection of the extension leadwire is of equal, if not greater, importance because it is not generally expendable and frequently costs as much as, or more than, the thermocouples and instruments combined.

**Leadwire Selection.** Choice, layout and installation of leadwires are important, especially when large numbers and great lengths are necessary. In brick yards, engine-testing laboratories, steel mills, blast furnaces and coke ovens, where extension leadwires are used under wide ambient-temperature conditions and subject to many deleterious factors, such as weather, and corrosive atmospheres, the possibilities of future maintenance difficulties and operational inaccuracies are multiplied.

Inasmuch as the electromotive force generated by a thermocouple is, at most, only about 50 millivolts (0.050 v), very minute leakage or galvanic action can produce serious inaccuracies in the temperature indications by changing the emf applied to the instrument. Therefore, the moisture-resistant qualities of insulation, which guard against leakage or galvanic action, are of primary importance. Weather, heat, and atmospheric corrosive-resistant qualities are of equal importance in forestalling leakage, direct short circuits, and grounds.

The following example illustrates the loss entailed when insufficient consideration is given to insulation qualities of thermocouple leadwires. The installation, in a large plant in the Gulf region, comprised a number of widely separated thermocouples. Leadwires from each thermocouple came to a central point where an indicating instrument could be selectively switched to each. The number of points involved, the length of leadwires, and the fact that the wiring was embedded in concrete flooring and walls made the installation cost many times that of the instrument itself.

**Insulation Failures.** The instrument manufacturer's recommendation on the type of leadwire insulation specifically required for this installation was disregarded. When the system was put in operation, it was found that many inaccuracies existed in the temperature indications of the instruments. The error became progressively worse until the entire system was useless. After determining that neither the instrument nor the various thermocouples were at fault, it became obvious that the trouble lay in the concealed extension leads.

Diligent searching and testing disclosed that high humidity prevalent in the area had introduced moisture into the insulation. As a result, the insulation impregnant became an electrolyte and a galvanic effect was produced between the two dissimilar metals comprising the conductors. Inasmuch as the extension leads were embedded in the building structure, replacement was a major operation. Consequently the original leadwire installation resulted in a $200,000 loss, which could easily have been avoided had the plant used moisture-resistant insulation recommended by the manufacturer.

## WIRE AND COVERING

Where process control depends on consistent operation of the thermocouple system, leadwire importance is multiplied because the product quality and production is in jeopardy if leadwire troubles arise. In industrial processes, heat and dryness, no less than moisture, are usually potentially dangerous. Heat dries some insulations so they become brittle and highly absorbent, or are actually destroyed. Remember that leakages and similar effects, which may be inconsequential at higher voltages, such as 110 v, or even at one volt, produce serious errors in the minute voltages common to thermocouple circuits.

The technical angle can be divided into (1) wire and (2) insulation. Considerations for each in a specific installation are entirely independent of one another. Therefore, by fulfilling the requirements for type of wire and insulation, the proper extension leads for a specific case can be ascertained.

As stated, the emf that a thermocouple develops is determined by the temperature difference between the hot and cold junctions of the thermocouple. Since the leadwires extend the cold junction to their farthermost ends, they *must* have thermoelectric characteristics similar to those of the actual thermocouple wires. Otherwise, there is a thermoelectric effect at the junctures between the actual thermocouple wires and extension leads that results in erroneous readings.

**Fig. 2—When stocking leadwire for pyrometer installation use great care to keep identification on coils unless color code is accurately recorded**

**Wire Conductors.** Usually the same metals are used for the extension wires as for the thermocouple wires themselves, but at times this is economically impracticable. If the thermoelectric characteristics of the leadwires and those of the thermocouple itself conform, however, results are the same regardless of the materials used. For example, it is unnecessary and economically prohibitive to use platinum-platinum rhodium leadwires with a platinum-platinum rhodium thermocouple. Consequently, a cheaper combination of metals (such as copper-copper nickel), whose thermoelectric characteristics conform within the required limits, gives satisfactory results.

As for wire size, the only factor of importance is the effect of external resistance upon the indicating instrument. The calibrated galvanometer (millivoltmeter) instrument requires that resistance of the external leads be as low as practicable, especially where multiple measurements are made from thermocouples at greatly varying distances from the instrument. Usually #14 B&S gage wire is used. With the galvanometer-actuated potentiometer instrument, wire can generally be smaller since the degree of accuracy does not depend on the external resistance in the circuit. As a rule, #16 B&S gage wire is used. Where external resistance has negligible effect upon an instrument's operating characteristics, extension leads as small as or smaller than #20 B&S gage are acceptable.

For most installations, solid conductors are used; but where the thermocouple is moved from one application to another, the stranded conductor is used to avoid frequent breakage.

**Insulation Qualities.** Insulation surrounding the leadwire conductors must not only act as a dielectric (having high electrical resistance) between the two conductors and between the two conductors and ground, but must exclude the entrance or absorption of deleterious materials that give an unfavorable electrical reaction.

Primarily, the insulation has to be a good dielectric. It is of the utmost importance that the insulating qualities remain effective throughout any conditions of temperature, humidity, corrosive atmosphere, etc, to which the leadwires may be subjected. For example, it is often necessary for the insulation to withstand weathering in such open-air installations as brick or coke ovens.

Here the insulation must withstand both excessive wetting and baking by the sun without serious deterioration in its dielectric strength. Where the leadwire is not subject to weather deterioration, other detrimental conditions, such as steam, flame, corrosive atmosphere and heat have to be considered as far as the insulation is concerned; one capable of withstanding these conditions is selected.

Examination of a piece of leadwire, shows there are two, or sometimes three, layers of insulation. That directly around the conductor is a protective covering with high dielectric strength, which provides the primary electrical insulation. The outer covering binds the two conductors into cable form, insulates them from the conduit or ground, and furnishes mechanical and chemical protection. Both the inner and outer insulations should be of material resistant to both physical and chemical deterioration so the dielectric properties remain effective. This is

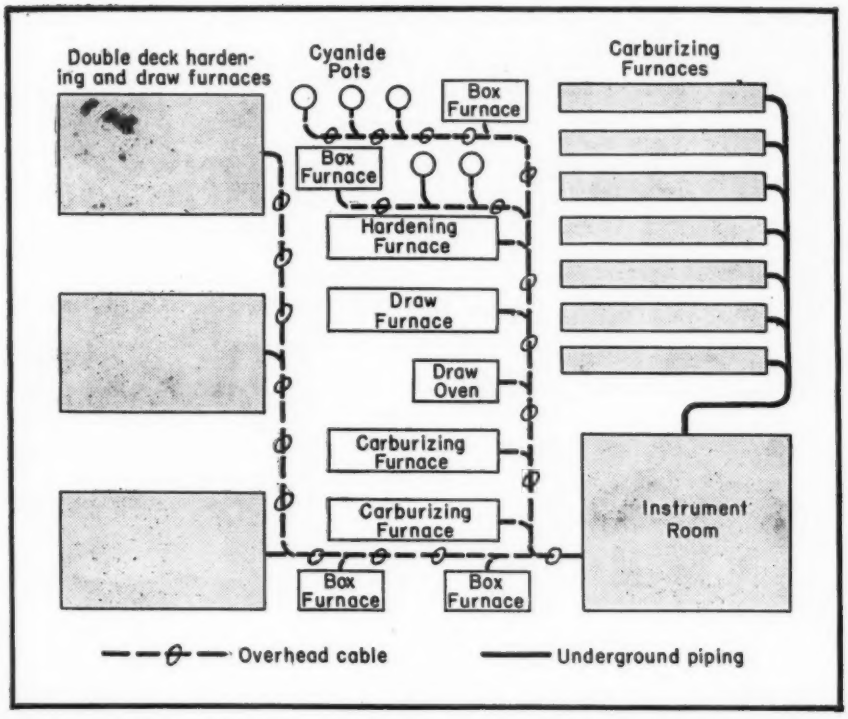



**Fig. 3—Typical pyrometer layout shows part of wiring underground, part overhead. Furnaces use asbestos-covered leadwire. Underground wires in conduit**

especially important should trouble develop where it is difficult to replace the leadwire.

A metal covering protects against mechanical wear and tear, when necessary. This is generally iron or steel conduit or a lead sheath. The latter is desirable where excessive moisture or corrosive atmosphere is encountered. Conduit is necessary when there is danger of mechanical abrasion or penetration that could result in destruction of the insulation.

**Wire Metals.** Extension leadwire is available with thermoelectric properties to conform to any thermocouple and with insulation to fit any installation condition. Following are the most commonly used thermocouples with the kinds and sizes of extension leadwire supplied:

Iron-constantan (IC) thermocouples: 14-gage solid conductors, 16-gage solid or stranded conductors consisting of a positive conductor of iron and a negative of constantan.

Chromel-alumel (MA) thermocouples: 15-gage solid conductor, 16-gage solid or stranded conductors consisting of a positive conductor of copper and a negative of constantan. Also, 14-gage solid conductors consisting of a positive conductor of chromel and a negative of alumel.

Because chromel-alumel leadwire is costly, copper-constantan is used for installations involving thermocouple terminal head temperatures up to 250 F. Above this temperature, the relationship between temperature and developed emf for copper-constantan becomes increasingly different from that for chromel-alumel. Thus it is necessary to use the more costly chromel-alumel combination to avoid serious errors in temperature indications.

Platinum-platinum rhodium thermocouples: 16-gage solid or stranded conductors consisting of a positive conductor of copper and a negative conductor of a special alloy. (Leadwires of the special alloy and copper were developed to be equivalent in their thermoelectric characteristics to platinum-platinum rhodium. Platinum is a noble metal and consequently quite costly.

Copper-constantan (CC) thermocouples: 20-gage conductors consisting of a positive conductor of copper and a negative conductor of constantan.

The foregoing conductors are available with different kinds of insulation, to meet specific installation conditions. Not all conductors are available in all types of insulation, inasmuch as industrial requirements are such that each type of thermocouple is not subject to all conditions of exposure.

The following types of insulations are available:

Polyvinyl thermoplastic: General-purpose insulation, for temperature conditions under 140 F, greatly resists deterioration and moisture.

Felted, wax-impregnated asbestos: high-temperature, flame- and moisture-resistant insulation. Generally used for temperature range from 140 to 400 F. The asbestos, impregnated with a flame- and moisture-proof wax, forms an insulation suitable where flames, steam and high temperatures are encountered. It also has resistance to moisture.

Rubber: Flexible, moisture-resistant insulation. Generally used where flexibility is the paramount factor, as in portable installations, and where the temperature does not exceed 110 F.

Since it is essential that the polarity be observed in connecting extension leadwires, a color should identify the electrical polarity of each conductor. The table shows the insulation color of each individual conductor for the various kinds of extension leadwires and associated thermocouples, supplied by one manufacturer.

As in the insulation around individual conductors, the outer insulation is color-coded to identify its thermoelectric characteristics (with which thermocouple used, etc).

(*Continued on page* 150)

## Color of Leadwire Insulation

| Associated thermocouple | Negative conductor | Positive conductor |
|---|---|---|
| Iron constantan (IC) | Red | White |
| | Red | Gray* |
| Chromel alumel (MA) | Red | Purple |
| | Red | Yellow** |
| Platinum-platinum rhodium (QR or HER) | Red | Black |
| Copper constantan (CC) | Red | Blue |

* Identifies a more accurate wire of premium grade for use with (IC) thermocouples in applications where accuracy is put above cost.

** Identifies the wire used with (MA) thermocouples at terminal head temperatures above 250 F.

# WATERWALLS: A Must With High Boiler-Water Concentrations

**Contrary to popular misconception waterwalls are not highly vulnerable to contaminated boiler water. Here's why a steam generator with such equipment proves more reliable even with dirty water than a boiler having a wholly refractory furnace**

By MAX H KUHNER
*Chief Mechanical Engineer, Riley Stoker Corp*

▶ EXPERIENCE WITH OLDER BOILERS has often been the basis for opinions holding that waterwalls should not be used where high boiler-water concentrations must be maintained. In such units there may have been rapid scale formation and frequent tube losses. Significantly, the trouble was concentrated on the tubes of the first few rows above the furnace. Since these are exposed to the furnace radiant heat it seems logical to conclude that waterwalls would be even more critical as they surround the furnace. How can waterwalls exist under unfavorable conditions if tubes of older standard boilers were constantly in trouble?

**Early Waterwall Troubles.** Many difficulties experienced with early waterwall installations were blamed on boiler water, whereas the design actually caused the troubles. Efforts to improve feedwater are always a step in the right direction, but many times no noticeable benefits in waterwall maintenance resulted. The difficulties were cleared up only after extensive alterations to the waterwall system, which invariably consisted of additions to feeder and steam offtake areas resulting in improved circulation.

**High Water Concentrations.** This does not mean that correct water preparation is not one of the most important factors for trouble-free service, but extent of water treatment is, after all, a problem of economics. It is governed by (1) nature of raw water (2) proportion of makeup (3) steam pressure and temperature (4) type and capacity of steam plant (5) load factor and many other considerations. If properly designed, boilers that must operate with waters of high concentrations experience no difficulty.

There are quite a number of industrial boilers operating at 400 to 800 psig, and up to 800 F, where water concentrations between 4000 and 6000 ppm must be maintained. One plant operates boilers with over 15,000 ppm total concentration with entire satisfaction. Steam purity and boiler availability are as high as with many boilers in which concentrations are below 1000 ppm. Proper boiler design and capable operating personnel are the answers to satisfactory performance with these water conditions.

Factors permitting operation with high boiler-water concentrations are:

(a) High water-flow rates, through boiler tubes and headers, keep solids in suspension, but they are permitted to settle out in large water drums placed near the lowest point in the system from where sludge can be blown down. High velocities make it difficult for solids to adhere to tube-wall interiors, and steam bubbles are swept off as fast as they form.

(b) Steam released above the boiler-drum working level prevents turbulence in the steam-release drums, and prevents or reduces foaming. This measure, combined with an efficient steam-purifying system, assures reasonably

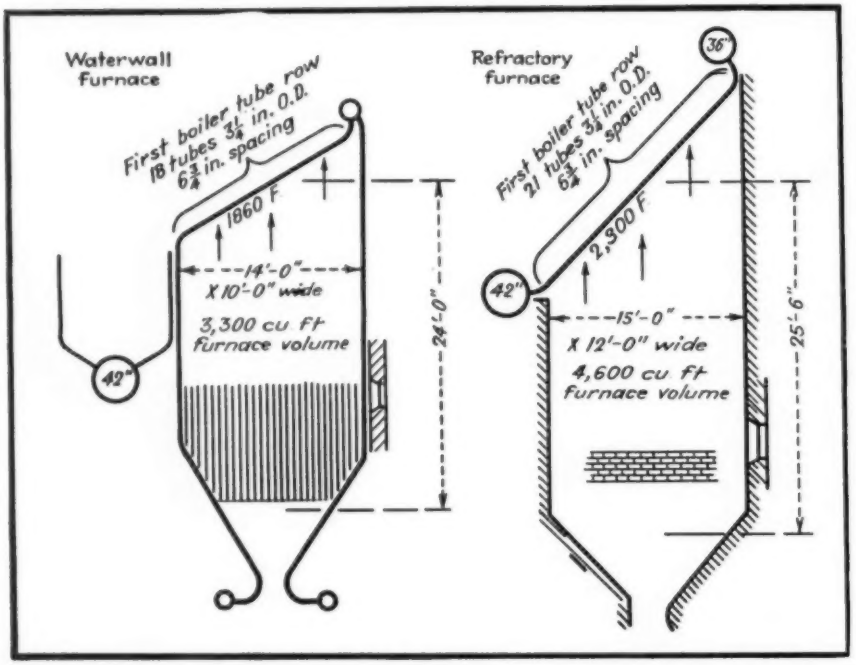



**Fig. 1—Comparison of waterwall and refractory furnaces having equal total heat releases. Waterwall furnace has 1400-sq-ft envelope area, all watertube covered, and 21,000 Btu per cu ft per hr max heat release. Refractory furnace has 1830-sq-ft envelope area of which 240 sq ft are covered by first row of boiler tubes, remainder being refractory, and a 15,000 Btu per cu ft per hr maximum heat release rate. Note the difference in furnace-exit gas temperature**

dry and clean steam leaving the drum.[1]

(c) Complete watercooling of furnace walls prevents concentrated heat input to a limited area of tube surface with localized overheating possibilities. This arrangement distributes furnace heat radiations over a large steam-generating area.[2]

Importance of this last factor becomes clear by comparing what happens in the furnaces of two boiler installations, Fig. 1. One is a completely water-cooled furnace; the other has only the first row of boiler tubes for watercooling. Both boilers are designed to operate under identical steam conditions: 50,000 lb per hr, 400 psig, 650 F and 212-F feedwater. Each unit operates at 84% over-all efficiency burning pulverized Eastern bituminous coal having 13,800 Btu per lb, and a 2400-F ash-fusion temperature.

The table contains calculations that demonstrate what happens in the two furnaces when generating 50,000 lb of steam per hr.

Note that combustion-gas temperature leaving the watercooled furnace is far below the ash-fusion temperature. This is maintained with only 20% excess air corresponding to 15.5% $CO_2$. In the refractory furnace, however, the exit-gas temperature is 2300 F, only 100 F below ash-fusion temperature, in spite of 45% excess air producing 12.8% $CO_2$. This condition follows from the very limited watercooling in the refractory furnace. Only the first row of boiler tubes can see the fire. Although heat absorption rates per sq ft of this surface are extremely high, see table—item 16, the total heat recovered by radiation is so low that almost 50% more heat is carried out of the furnace by the gas than with the watercooled furnace, table—item 8.

Usually the first row of boiler tubes is the heating surface receiving the greatest heat input. They not only are exposed to the radiant furnace heat, but also are in the path of the high-temperature gas leaving the furnace; as a result they are subjected to the highest rate of convection heat recovery. In item 16 the first row of boiler tubes absorbs 18,100 Btu per hr per sq ft for the watercooled furnace, the sum of 8070 Btu radiant heat and 10,030 Btu convection heat. This total rate is conservative, corresponding to about 23 lb of steam per sq ft per hr.

Conditions are much more serious for the refractory furnace where the first-row tubes must absorb 25,100 Btu per sq ft per hr by radiation alone. In addition, 14,900 Btu per sq ft per hr are absorbed by convection, making a total of 40,000 Btu corresponding to 51.5 lb of steam per hr per sq ft. This is over 2.2 times as much as for the waterwall design!

**Scale-Formation Rate.** Assuming the scale-formation rate in boiler tubes to be in direct proportion to the evaporation rate the above figures indicate the watercooled-furnace boiler could operate over 2.2 times as long between cleanings as the all-refractory boiler. Heat-transfer rate through the tube wall diminishes as boiler-scale thickness increases. This is why scale deposits in boiler tubes quite far from the furnace are often found to be almost as heavy as those in the tubes nearest the furnace. Boiler scale insulates the tube wall, prevents rapid heat transfer, and causes less temperature reduction of the gas passing over those tubes.

With the tubes nearer the furnace in the first pass "scaled up" the heating surface placed farther away from the furnace becomes a more effective steaming surface until scale in these tubes is heavy enough to prevent heat transfer again. Boiler scaling is thus progressive, starting with the first row of tubes and gradually extending to last row.

As the zone of active steam generation moves nearer the gas exit the normal direction of boiler steam-water circulation is disturbed. Even if tube failures should not happen, reversal and stoppage of circulation in some tubes would certainly cause tube trouble.

**Conclusion.** The use of waterwalls for a boiler installation that must operate with high boiler-water concentration is not only advisable but is a *must* for reliable service. Furnace waterwalls allow the distribution of furnace heat over a large surface. Heat recovered by radiation in waterwalls materially reduces furnace temperatures and the gas temperature leaving the furnace.

Highly concentrated rates of heat input to a limited area of heating surface are prevented. Formation of boiler scale in waterwalls and boiler tubes takes place at much lower rates when compared with a boiler without cooling provisions in the furnace.

## COMPARISON OF FURNACE PERFORMANCE IN TWO BOILERS OPERATING AT SAME CONDITIONS

*50,000 lb per hr steam flow at 400 psig, 650 F; feedwater at 212 F; over-all efficiency, 84% see Fig. 1 for furnace dimensions.*

| | | Furnace type: Waterwall | Refractory |
|---|---|---|---|
| 1 | Furnace heat release, 1000 Btu per hr | 68,700 | 68,700 |
| 2 | Projected watercooled area of furnace envelope, sq ft | 1,400 | 240 |
| 3 | Heat release per sq ft of watercooled area of furnace, Btu per hr, (1)/(2) | 49,000 | 286,000 |
| 4 | Excess air needed to limit furnace temperature, % | 20 | 45 |
| 5 | $CO_2$ in furnace-exit gas, % | 15.5 | 12.8 |
| 6 | Calculated furnace-exit gas temperature, F | 1,860 | 2,300 |
| 7 | Gas flow leaving furnace, lb per hr | 67,600 | 80,600 |
| 8 | Gas heat content at furnace exit, 1000 Btu per hr | 33,200 | 49,700 |
| 9 | Radiant heat absorbed by watercooled surface in furnace, 1000 Btu per hr, (1)−(8) | 35,500 | 19,000 |
| 10 | Radiant heat absorbed by watercooled surface in furnace, Btu per sq ft per hr, (9)/(2) | 25,300 | 79,000 |
| 11 | Projected area of tubes in first row, sq ft | 73 | 119 |
| 12 | Radiant heat absorbed by first row of boiler tubes, 1000 Btu per hr, (10)×(11) | 1,847 | 9,410 |
| 13 | Total tubular heating surface of first row of boiler tubes, sq ft | 230 | 375 |
| 14 | Calculated convection heat absorbed by first row of boiler tubes, 1000 Btu per hr | 2,320 | 5,570 |
| 15 | Total heat absorbed by first row of boiler tubes, 1000 Btu per hr, (12)+(14) | 4,167 | 14,980 |
| 16 | Total heat recovered by first row of boiler tubes, Btu per sq ft per hr, (15)/(13) | 18,100 | 40,000 |
| 17 | Radiant heat absorbed by tubular area of furnace waterwall tubes, Btu per sq ft per hr, (10)/$\pi$ | 8,070 | —— |
| 18 | Ratio of highest heat loading of tubes in watercooled furnace to that in refractory furnace | 1:2.21 | |

[1] "How Steam Is Released in Water Tube Boiler Drums," by M H Kuhner, *Power Plant Engineering*, Sept 1944, pp 92–4.

[2] Localized overheating of waterwall tubes may follow from incorrect burner location permitting flame impingement on wall tubes. Tubes of any boiler overheat if exposed to blow-torch action of live flame.

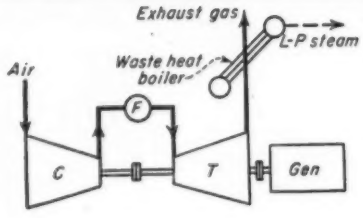



Fig. 4—Simple-cycle gas-turbine plant producing low-pressure steam from exhaust gas in the waste-heat boiler

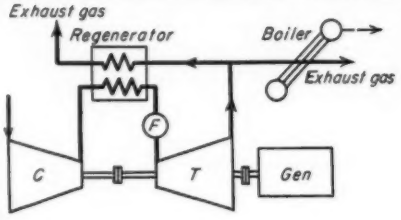



Fig. 5—Regenerative-cycle gas-turbine plant can use waste-heat boiler in parallel with the unit's regenerator

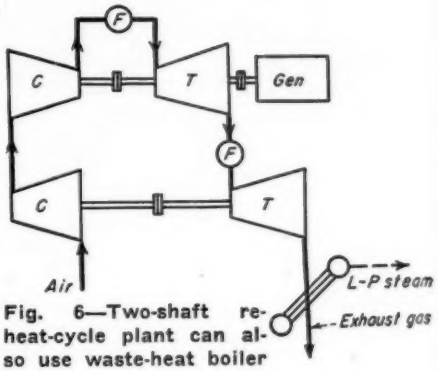



Fig. 6—Two-shaft reheat-cycle plant can also use waste-heat boiler

# Gas-Turbine Possibilities in the Stationary Power Plant Field

**Here are suggested means of adapting gas-turbine plants to produce steam as well as power. The outstanding versatility of this prime mover is described in the second part of a 2-part paper by L N Rowley and B G A Skrotzki, both of POWER ***

IN INDUSTRIAL-POWER applications, the plant must usually supply process heat as well as mechanical or electrical energy. In selecting the plant the usual economic factors apply, but the effect of the relationship between the two kinds of loads—heat and power—overrides to the extent that it largely determines the nature of the plant selected.

Any comparison of plants for industrial-power supply usually boils down to an examination of their ability to meet a variety of heat and power conditions. This test can be summed up in the answers to three questions: (1) Can the plant's ratio of heat to power be altered readily by design, and to what extent? (2) In an operating plant can the heat-power ratio be regulated readily to meet load fluctuations? (3) At what temperature level or levels is process heat available?

**Current Plant Types.** Let's see how two currently popular types of plants measure up to these questions and how the answers have influenced their application. By appropriate combinations of extraction and backpressure turbines a wide range of heat-power ratios can be obtained with steam plants, and suitable controls are available for readily adjusting the balance between heat and power. Heat in the form of steam can be provided at any level up to boiler conditions of, say, about 1000 F as an upper limit. The steam-turbine plant represents about the maximum in industrial-power versatility, but shows up best where the ratio of heat to power is high.

The diesel plant produces shaft power at the highest efficiency, but its heat-producing possibilities are limited. Of the fuel input to a conventional engine, not more than 50 to 60% is recoverable as heat even in theory, while in practice the maximum recovery is much less. The heat-power ratio is more or less constant and cannot be altered readily in operation. Furthermore, heat is available at relatively low levels. Jacket water temperatures rarely exceed 180 F; exhaust temperature runs about 400 to 550 F for 2-cycle engines, and 650 to 800 F for 4-cycle. Hence, diesel plants find widest use where power requirements are high in relation to heat requirements; in other words, where heat-power ratio is low.

Comparatively little has been done to explore the possibilities of the gas turbine for industrial-power applications, but it seems likely to occupy a place somewhat between the steam-turbine and the diesel-engine plant. Let's see in a qualitative way why this is so.

**Waste-Heat Boilers.** The arrangement commonly visualized for industrial power has a waste-heat boiler in place of the regenerator or in parallel with it. A series arrangement has also been suggested. Taking the simpler hookup first, Fig. 4, it can be seen that with a single-shaft plant, output control will be by temperature variation, with gas-flow rate essentially constant. As temperature varies with load, heat available in the exhaust will also vary with load. To this extent, the situation closely parallels that encountered in diesel plants, but with the exception that gas flow per kwhr is much higher, about 100 lb per kwhr for gas turbines against about 13 lb for diesels. According to Pfenninger of Brown Boveri,

* Second part of a 2-part paper presented before the Midwest Power Conference, Chicago, April 2, 1947. First part appeared in the June 1947 issue.

about 12 lb per kwhr of steam can be produced by an arrangement similar to Fig. 4.

The ratio of heat to power of this hookup cannot be altered to any appreciable extent by design, nor is it possible to meet demand variations readily in operation. When power loads are high and steam loads low, the boiler can be bypassed, but little can be done to meet the reverse condition. It might be thought that the turbine could be bypassed or gas extracted from it after partial expansion, as in steam-turbine plants. But the high cost of compression work done on the gas before heating makes this undesirable. The only other solution, equally applicable in diesel plants, lies in fitting the boiler with auxiliary oil burners to operate when power loads are light and steam loads heavy. Since gas turbines employ very high excess air ratios, sufficient oxygen will be available in the exhaust to support combustion.

**Parallel Setup.** If the waste-heat boiler is in parallel with a regenerator, operation at high power loads and low steam loads is more efficient, Fig. 5. A suitable valve setup divides gas flow between boiler and regenerator in accordance with steam-load variations so the plant always operates under the most favorable conditions. Choice between this hookup and Fig. 4 would depend on the value of the added efficiency at low-heat-power ratios compared with the cost of the added equipment.

To improve part-load efficiency on small gas-turbine plants and to permit building plants of large total output without exceeding economical and mechanical limitations in size of rotating parts, 2-shaft designs are used, Fig. 6. This practice allows control by gas-flow variation, with the temperature held essentially constant over a substantial part of the load range. For waste-heat recovery, this plant offers the advantage that gas temperature at the waste-heat boiler is at a high level over a great part of the load range. Although not shown, the hookup using a regenerator in parallel applies equally well to 2-shaft designs.

Industrial suitability of gas-turbine plants fitted for exhaust-heat recovery may be summarized as follows: (1) They are less flexible in design and operation than steam-turbine plants and not so well suited for high heat-power ratios. (2) They are somewhat more flexible than the diesel plant on both counts. In fact, they seem best suited for intermediate heat-power ratios. According to an analysis by Pfenninger, Brown Boveri, a gas-turbine plant with waste-heat boiler compares with a backpressure steam-turbine plant producing steam at 85 psig, as shown in Table IV.

**High-Pressure Steam.** Most thinking about industrial-power gas turbines has dealt with heat recovery at the low end of the cycle. What are perhaps more interesting possibilities lie at the high end. Fig. 7 shows production of high-pressure steam at the combustion chamber. With forced-circulation "series" design, superheated steam at virtually any pressure and temperature could be generated. It then becomes possible to obtain any desired heat-power ratio from almost all power and no heat (the conventional gas-turbine plant) to all heat and little or no power (the Velox boiler). Absorption of heat at the combustion chamber reduces gas temperature at the turbine inlet, an operation normally done by excess air. To protect heat-transfer surfaces, steam generation could not be allowed to drop below a certain minimum flow.

The principal problem in this arrangement lies in controlling steam output to meet variations in demand for power and steam. While it is possible to visualize bypass arrangements that would either alter the effective heating surface or the gas flow over a fixed amount of surface, such schemes appear unnecessarily complex. For simplicity it might be better to generate steam in accordance with whatever gas flow is required for shaft power, and find some way to utilize excess steam in the cycle itself.

In Fig. 8, part of the steam produced is diverted back into the gas circuit and the turbine becomes a combined gas-vapor machine. With normal expansion ratios this should involve no moisture problem at the exhaust; the added working fluid increases the shaft output. If steam is generated at a pressure above turbine throttle pressure, as is likely, an arrangement like that in Fig. 9 could be used. Here the excess steam expands first through a steam turbine, say an impulse wheel, which exhausts to the gas-vapor turbine at its normal inlet pressure. Governing should be no more complex than that of the extraction-condensing and backpressure steam turbines now widely used.

Generation of steam at the cycle's high end might well be combined with recovery of heat at the low end, leading to hookups like that in Fig. 10, in which an economizer heats feedwater for the steam-generating surface at the combustion chamber.

**Combined Air-Steam Plant.** Another interesting steam- and gas-turbine com-

## GAS-TURBINE PLANTS GENERATING HIGH-PRESSURE STEAM

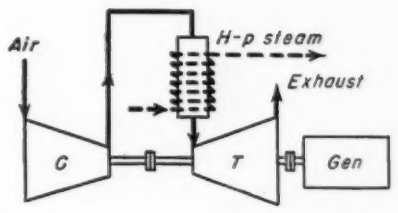



Fig. 7—Simple-cycle gas-turbine plant with high-pressure-steam generating surface provided in the furnace

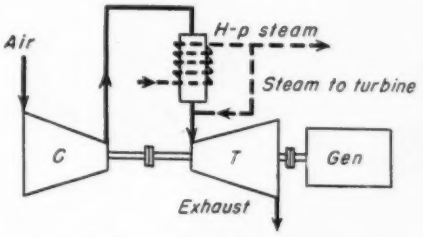



Fig. 8—Part of high-pressure steam output can be throttled and passed through turbine to increase the total shaft power of the gas-turbine plant

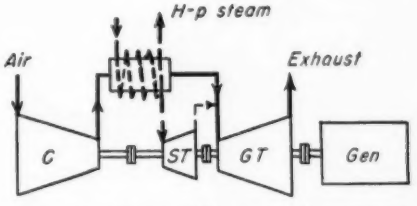



Fig. 9—To utilize high-pressure steam efficiently for shaft power production it can first be passed through a steam turbine on the shaft

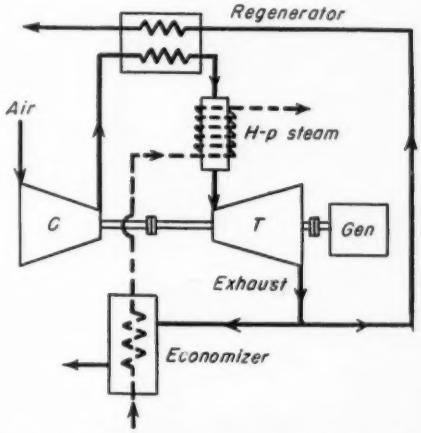



Fig. 10—Some of exhaust can be diverted as needed from regenerator to preheat feedwater in an economizer

bination has been suggested by W Karrer, Oerlikon Works, Zurich. He points out that steam boiler plants designed for exclusive supply of heat can be converted to highly economical plants for heat and power by raising boiler pressure and temperature, and expanding the steam in a backpressure turbine. He then shows that the shaft power can be about doubled by addition of an air turbine and its compressor, and that the increased fuel input required is favorably utilized.

As shown in Fig. 11, a fuel-fired boiler supplies steam to a backpressure turbine. Flue gas from the boiler first heats air for the turbine and then feedwater for the boiler. The air-turbine circuit starts with a compressor taking in fresh air. After air pressure has been raised, air flows through a regenerator, picking up heat from the turbine exhaust, and then flows through the flue-gas air heater. Heated pressure air then expands through the turbine, and flows through the regenerator to the boiler where it serves as combustion air. Turbine output is sufficient to drive the compressor and produce electrical energy to add to that generated by the backpressure turbine.

It is realized that these various gas-turbine industrial-plant hookups have been put forward without the exhaustive analysis required to establish fully their practical and economic feasibility. It is believed, however, that they indicate worthwhile possibilities for the gas turbine in this field, and that they should be the subject of further study by gas-turbine engineers and power-plant designers.

**Pressure-Reducing Turbines.** To complete this phase of the record, a further well-established power application of gas turbines should have mention. Where gas is available at relatively high pressure, as in gas fields, power can be obtained simply and cheaply by allowing this gas to expand through a turbine without either combustion or compression. The turbine merely takes the place of a reducing valve and the gas is available for other uses, unchanged except in pressure. A number of such turbines have been built and several papers have discussed their characteristics in detail.

**Houdry Process.** In rounding up industrial gas-turbine possibilities, one should not overlook their application where large volumes of air must be compressed efficiently. The gas turbine found early use commercially in the Houdry process of catalytic refining, a typical example of this kind. In this process, air must be supplied to regenerate the catalyst, and in doing so it picks up heat. Exhaust from the catalyst chambers then expands in a turbine generating sufficient shaft power to drive the compressor and furnish some electrical energy as a dividend.

More than 30 units have been applied in refineries; experience gained with them is the most complete yet recorded. For six such units, with a total life at that time of more than 25 unit-years, A E Pew, Sun Oil Co, reported an average availability of better than 98%, comparable to best steam-turbine practice.

**Blast Furnaces.** Blast-furnace blowing represents another field for the gas-turbine set as a compressed-air producer. The compressor supplying the air for the turbine also supplies blast air, making a separate blower unnecessary. Where lower blast temperatures permit use of a steel blast heater in place of a Cowper stove, considerable space can be saved and higher efficiency obtained. Gas for the turbine and blast air are both heated with the products of combustion of a single combustion chamber, which is supercharged to turbine pressure.

Heat consumption of a steam-turbine plant with Cowper stove is about 48 Btu per cu ft, against about 45 Btu for a gas-turbine set with Cowper stove, and 38 Btu for the gas-turbine steel-blast-heater combination. Since, with the usual arrangement, blast quantity is less than half total air flow through the axial compressor, blast volume can be reduced to about 40% without reaching the pumping limit; the fact that the pressure-volume curve of an axial blower is essentially a straight line does not constitute a drawback.

In view of the tendency to speed reaction time of chemical processes by devices such as supercharging, it is likely that many other attractive possibilities for the gas turbine as a compressor will develop.

**Conclusion.** The foregoing makes it clear that in the gas turbine we have a prime mover of outstanding versatility that is already demonstrated by applications in virtually all fields, but not yet fully explored in many. It seems reasonable to conclude that within the field of stationary power there are many applications to which the gas turbine is inherently suited if its many interesting characteristics are fully exploited. Furthermore, many of these possibilities can be realized with gas turbines of such conservative design that their production today on a fully commercial basis seems entirely justified. As technological advances remove present limitations on efficiency and fuel range, the field of application will widen.

We should remember, however, that historically no prime mover ever succeeds in fully supplanting others. Each tends to find its special place in a world that finds ever larger and more far-reaching needs for stationary and propulsive power.

**TABLE IV—COMPARISON OF GAS-TURBINE AND STEAM-TURBINE PLANT PERFORMANCE**

| | | | | |
|---|---|---|---|---|
| Steam consumption for heating, lb per kwhr..... | 0 | 4 | 8 | 12 |
| Total thermal efficiency of plant, %: | | | | |
| a. Gas turbine with waste-heat boiler..... | 25 | 56 | 63 | 70 |
| b. Backpressure steam-turbine plant..... | 25 | 50 | 62 | 74 |

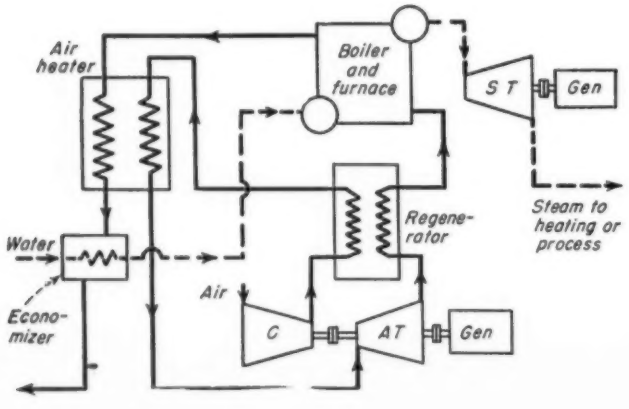



**Fig. 11 — Scheme proposed by W Karrer combines air turbine with a conventional steam-boiler plant to increase relative output of electrical energy**

# How To Figure Piping Hanger Loads

**Here's the practical way piping engineers go about finding what load each hanger in a complicated system must carry. It takes careful analysis to keep within specified limits forces acting at points of connection to principal power equipment**

By EDMUND HOWARTH
*Engineer, Grinnell Co, Inc.*

▶ THE THERMAL DEFLECTION of piping in modern high-pressure high-temperature power stations has made it necessary to use flexible supports. Most manufacturers of power-station equipment place limitations on the allowable loads to be exerted on their apparatus by piping systems at the points of connection. Boiler and turbine manufacturers, especially, are concerned about pipe weight at connections, and sometimes specify zero reaction.

Under these conditions piping engineers need to know the procedure to follow in calculating loads at the various support points on a pipeline, especially where the pipe load at the anchor or terminal point is limited.

Pipelines must be supported so the load on terminal points is not greater than that allowable throughout the full range of thermal expansion. Then the magnitude of the supporting force at each pipe-suspension point must be known, and the total of these forces must be equal to the total weight of the piping system.

The example here is limited to as few sections as possible, but at the same time incorporates most of the problems commonly encountered in power-station piping support. Selection of support type is not included.

**First Step.** With the piping system specified as in Fig. 1 with all given dimensions, all the weights involved must be determined as in the table. After checking the weights to insure inclusion

## LIST OF WEIGHTS IN PIPING SYSTEM

| Description | Weight, lb | Insulation weight, lb | Total weight, lb | Weight used in calculations, lb | Unit |
|---|---|---|---|---|---|
| Schedule 160 pipe, 12-in. | 161 | 36.5 | 197.5 | 197.5 | Per ft |
| Schedule 160 pipe, 6 in. | 45.3 | 24.2 | 69.5 | 69.5 | Per ft |
| 900-lb stop and check valve, 12 in. | 3960 | 394.0 | 4354.0 | 4354.0 | Each |
| 900-lb lap flange | 445 | 54.75 | 499.75 | 500.0 | Each |
| 900-lb flanged T, 12x12x6 in. | 1683 | 321.0 | 2004.0 | 2004.0 | Each |
| 900-lb flanged gate valve, 12-in. | 4024 | 394.0 | 4418.0 | 4418.0 | Each |
| Schedule 160 weld L, 12 in. | 460 | 109.5 | 569.5 | 570.0 | Each |
| W N F S 900-lb flange, 6 in. | 116 | 36.3 | 152.3 | 152.0 | Each |
| Schedule 160 weld L, 6 in. | 59 | 36.3 | 95.3 | 95.0 | Each |
| 900-lb flanged globe valve, 6 in. | 1100 | 217.8 | 1317.8 | 1318.0 | Each |

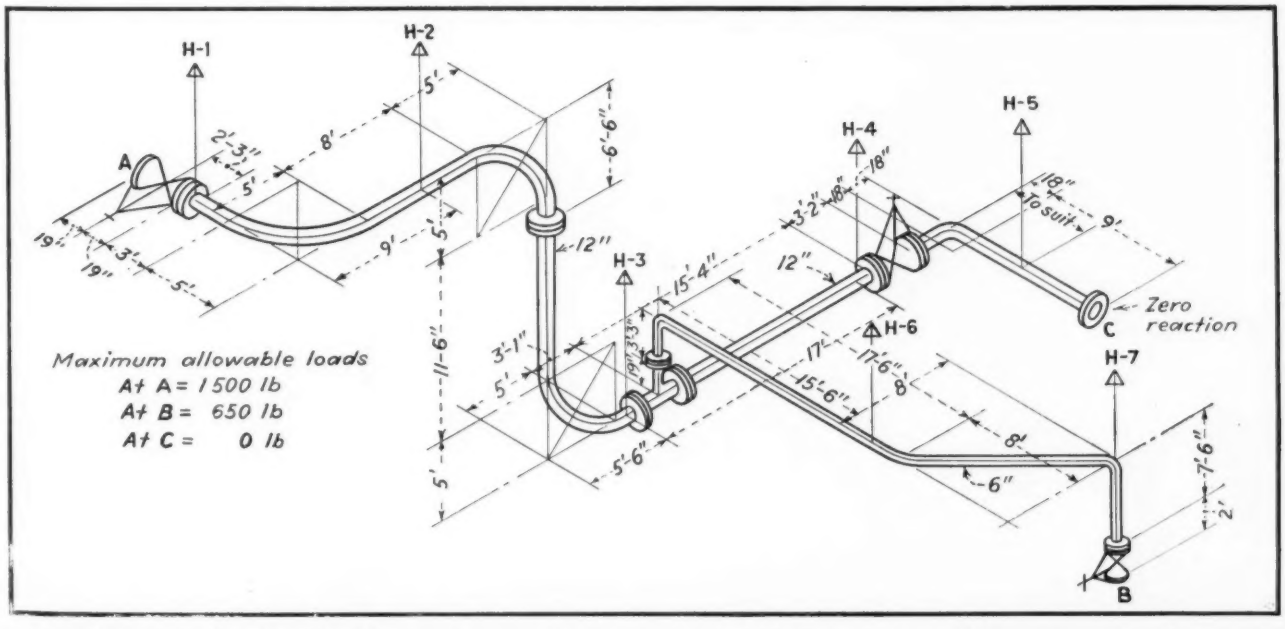



Fig. 1—Isometric drawing of piping system used as an example in calculating hanger loading. This system incorporates most of the problems commonly encountered in power-station piping support, analyzed in Fig. 2 to 7

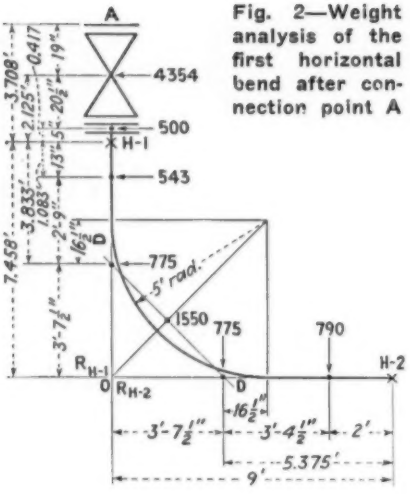



Fig. 2—Weight analysis of the first horizontal bend after connection point A

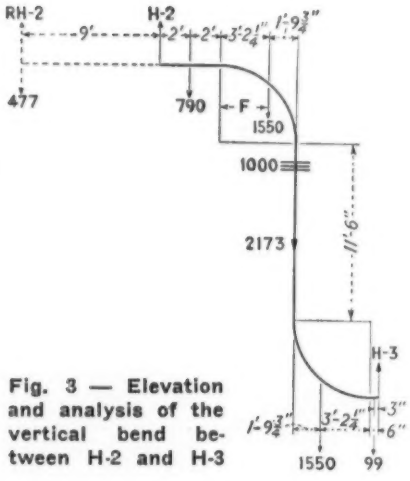



Fig. 3 — Elevation and analysis of the vertical bend between H-2 and H-3

of all items, the piping system must be isolated into separated sections, Fig. 2 to 7, for individual and progressive analysis.

**Section A to H-2.** First section to be analyzed is from connection *A* where reaction must not exceed 1500 lb to the hanger *H*-2, Fig. 2. In the single-line sketch all the dimensions and weights must be shown. Weights are located at the center of gravity of each piece of pipe, valve and fitting.

Weight of the 90-deg bend is shown as 1550 lb at the bend's center of gravity. Consider this bend as supported on an imaginary beam, which passes through the center of gravity and rests on the extensions of the tangents to the bend. This beam is shown, Fig. 2, resting on the tangents at a distance *D* of 1 ft, 4½ in. from the ends of the bend, and the load on each beam end is one half the total load, or 775 lb.

Distance *D* is found as follows:

$R$ = bend radius, ft
$\alpha$ = bend angle, deg

$$D = R\left(\tan\frac{\alpha}{2} + \frac{2}{\frac{\alpha\pi}{180}} - 2\csc\alpha\right)$$

$$D = 5\left(\tan 45 + \frac{2}{\frac{\pi}{2}} - 2\csc 90\right)$$

$D$ = 1.365 ft or 1 ft, 4½i n.
*For a 90-deg bend* $D$ = 0.273 (*bend radius*)

Now consider the forces between *H*-1 and *H*-2 as acting in two planes at right angles to each other, and both at right angles to the picture plane—all intersecting at *O*. There are two reactions at *O* designated as $R_{H-1}$ and $R_{H-2}$, the force on $R_{H-1}$ carried on hanger *H*-1, and force $R_{H-2}$ carried on hanger *H*-2.

Next take moments about *H*-1 and solve for $R_{H-2}$:

$7.458\,R_{H-2} = 543 \times 1.083 + 775 \times 3.833$
$R_{H-2}$ = 477 lb

Now solve for load on *H*-1, designated as *H'*-1, caused by weights between *H*-1 and $R_{H-2}$ by taking moments about $R_{H-2}$:

$7.458(H'\text{-}1) = 775 \times 3.625 + 543 \times 6.375$
$H'$-1 = 841 lb

This can also be found by taking the difference between the sum of the loads and the reaction $R_{H-2}$, or $H'$-1 = 543+775−477 = 841 lb.

By taking moments about *H*-2 solve for $R_{H-1}$:

$9R_{H-1} = 790 \times 2 + 775 \times 5.375$
$R_{H-1}$ = 638 lb

The load on *H*-2 caused by the weights between it and $R_{H-1}$ is then

$H'$-2 = 775 + 790 − 638 = 927 lb

Now determine the load on *H*-1 due to forces between it and *A*, and the force of $R_{H-1}$ acting at *O*. This is a simple beam, solved by taking moments about *H*-1 to find the reaction at *A*:

$500 \times 0.417 + 4354 \times 2.125 - 638 \times 7.458 - 3.708A = 0$
$A$ = 1268 lb.
Then $H''$-1 = 4354+500+638−1268 = 4224 lb

Total load on *H*-1 is sum of $H'$-1 and $H''$-1 or:

*H*-1 = 4224 + 841 = 5065 lb

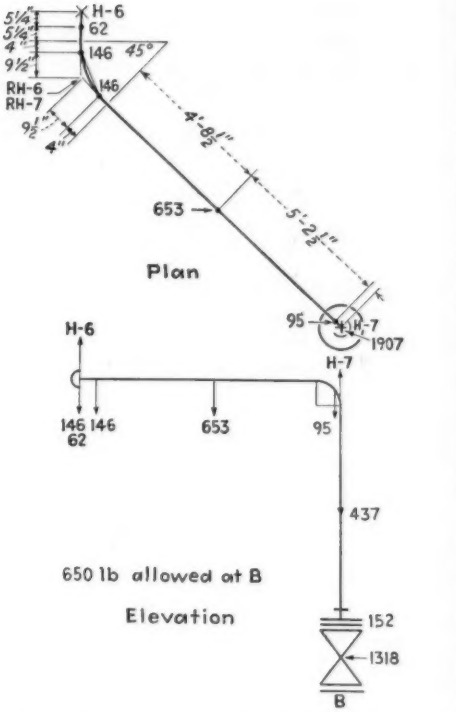



Fig. 4—Plan and elevation of 6 in. branch line between B and hanger H-6

**Section H-2 to H-3.** Fig. 3 shows this section in elevation with the location and magnitude of individual loads. The location *F* of the bend load is found by:

$F = R \sin\alpha\,(\alpha\pi/180)$
$F = 5\,(\pi/2) = 3.183$ ft
*For a 90-deg bend,* $F = 0.637 \times$ *radius*

All forces are in the vertical plane, so taking moments about *H*-2 solve for partial load *H'*-3 caused by weights between *H*-2 and *H*-3:

$14.5H'\text{-}3 = -477 \times 9 + 790 \times 2 + 1550 \times 7.187 + 3173 \times 9 + 1550 \times 10.813$
$H'$-3 = 3804 lb

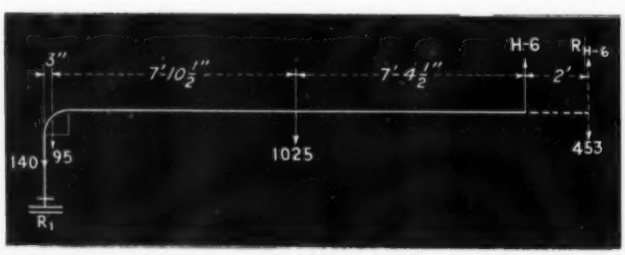



Fig. 5—Elevation and weight analysis of 6-in. branch line between hanger H-6 and the flange connection to T

Fig. 6—Elevation and weight analysis of 12-in. main line between hangers H-3 and H-4 including T fitting

Then partial load on $H$-2 from this same section is:

$H''$-2-477 +790 +1550 +1000 +2173 +1550 +99 − 3804 = 3835 lb

Total load on $H-2$ is then:
$H-2$ = 3835 + 927 = 4762 lb

**Section H-6 to B.** Pipe section between hangers $H$-4 and $H$-5 has an imposed load of the 6-in. line through the flanged T. This load must first be determined by solving for the loads on hangers $H$-6 and $H$-7, Fig. 4. The load and the imaginary beam reactions for the 45-deg bend are calculated as for the bend in Fig. 2.

Taking moments about $H$-6 solve for $R_{H-7}$:

$2R_{H-7} = 62 \times 0.437 + 146 \times 1.208$
$R_{H-7} = 102$ lb

Partial load on $H$-6 is:

$H'$-6 = 62 + 146 − 102 = 106 lb

Taking moments about $H$-7 and solving for $R_{H-6}$:

$11.3R_{H-6} = 95 \times 0.25 + 653 \times 5.458 + 146 \times 10.5$
$R_{H-6} = 453$ lb

Partial load on $H$-7 is:

$H'$-7 = 653 + 95 + 146 − 453 = 441 lb

Then with a 650-lb allowable load on connection $B$, and remembering $R_{H-7}$ has a load of 102 lb:

Total $H$-7 = 441 + 102 + 437 + 152 + 1318 − 650 = 1800 lb

**Section H-6 to T.** An elevation of this section of the 6-in. branch is given in Fig. 5. Taking moments about $R_1$ and solving for $H$-6, first find remaining partial load on this hanger:

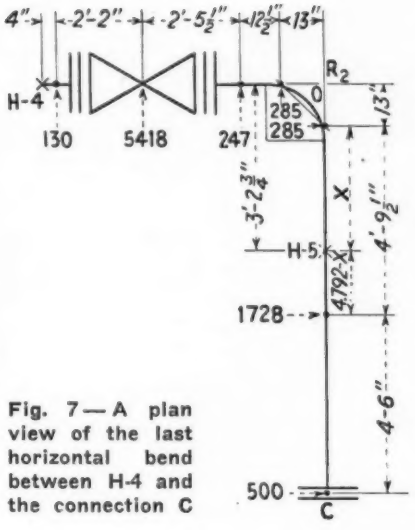



Fig. 7 — A plan view of the last horizontal bend between H-4 and the connection C

15.5 $H''$-6 = 95 × 0.25 + 1025 × 8.125 + 453 × 17.5
$H''$-6 = 1050 lb
Total $H$-6 = 1050 + 106 = 1156 lb

Partial load at $R_1$ = 95 + 1025 + 453 − 1050 = 523 lb
Total load at $R_1$ = 523 + 140 = 663 lb

**Section H-3 to H-4.** Fig. 6 shows this pipe section as a simple beam. Solve for the reactions by taking moments about $H$-3:

17 $H'$-4 = 148 × 0.375 + 3667 × 2.583 + 2488 × 10.708
$H'$-4 = 2128 lb
$H''$-3 = 148 + 3667 + 2488 − 2128 = 4175 lb

Total load on $H$-3 is sum of $H'$-3 and $H''$-3 or:

$H$-3 = 3804 + 4175 = 7979 lb

**Section H-4 to C.** In Fig. 7 consider the forces as acting in two planes which intersect at $O$. Calculate the reaction at $R_2$ due to loads in the plane $H$-4 to $O$:

7.083 $R_2$ = 130 × 0.333 + 5418 × 2.5 + 247 × 4.958 + 285 × 6
$R_2$ = 2333 lb
$H''$-4 = 130 + 5418 + 247 + 285 − 2333 = 3747 lb
Total $H$-4 = 3747 + 2128 = 5875 lb

Solve for load and location of $H$-5 by taking moments about $H$-5:

2333 (1.083 + $X$) + 285 $X$ = 1728 (4.792 − $X$) + 500 [4.5 + (4.792 − $X$)]
$X$ = 2.146 ft or 2 ft, 1¾ in.

$H$-5 is then located from $O$ at a distance of 2 ft, 1¾ in. plus 1 ft, 1 in. or a total of 3 ft, 2¾ in.

Check the moments about $H$-5:

2333 × 3.229 + 285 × 2.146 = 8144.9 ftlb
1728 × 2.646 + 500 × 7.146 = 8145.3 ftlb
Total load on $H$-5 = 2333 + 285 + 1728 + 500 = 4846 lb

**Summary.** Loads to be carried by each of the seven hangers are then: $H$-1, 5065 lb; $H$-2, 4762 lb; $H$-3, 7979 lb; $H$-4, 5875 lb; $H$-5, 4846 lb; $H$-6, 1156 lb; $H$-7, 1800 lb.

# New Fuel Nozzle's Finer Atomization Aids Gas-Turbine Development

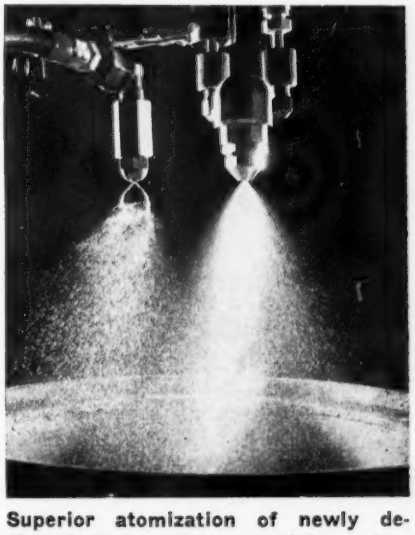
▶ AN OIL-FUEL NOZZLE, recently perfected by K V Smith, Westinghouse Research Laboratories, gives superior atomization at all fuel-flow rates, even those approaching zero. It performs effectively below the drizzle point of the conventional mechanical-atomizing nozzle, spraying a solid cone of heavy fog in contrast to the hollow cone produced by the older nozzle.

Developed in connection with gas-turbine combustion studies, it will be used on the 2000-hp gas-turbine set now under experimental development, POWER, Jan 1947, pp 98-102, which has been designed to run on bunker C oil.

Finer atomization is produced by a small flow of relatively low-pressure air (less than 1 cfm) that enters through six tiny air ducts cut at an angle in the nozzle. Convergence of these air streams in the atomizer sets up a miniature cyclone. This air blast collides with the incoming fuel and rips the heavy-oil droplets apart to form almost fog-sized particles.

Advantages of the new nozzle are: (1) It prevents unburned carbon particles caking the combustion chamber walls by more even distribution of finer fuel particles. (2) Superfine atomization over a wide range of loads prevents partial combustion because of large-sized droplets.

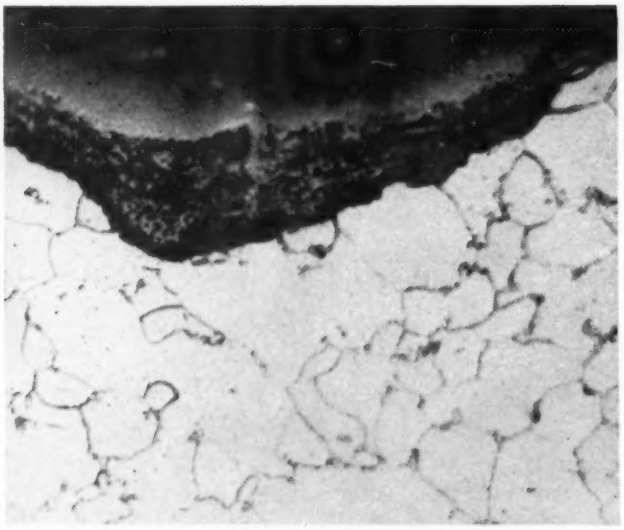
It has been found that 90 to 96% of the fuel energy is converted into heat over wide speed and load ranges, whereas with conventional nozzles combustion efficiency falls off to about half this value under some conditions.



Superior atomization of newly designed fuel nozzle, at right, when compared with conventional design is evident from greater number and smaller size of oil droplets. Oil pressure behind both nozzles is 20 psig. Photograph made with an exposure of 1/10,000 sec by a high-speed camera

# SOLVENTS Offer Quick Removal Of Mill Scale From New Boilers

**This troublemaker sets the stage for an active corrosive attack. Here is an easy way to remove it before you operate a new boiler**



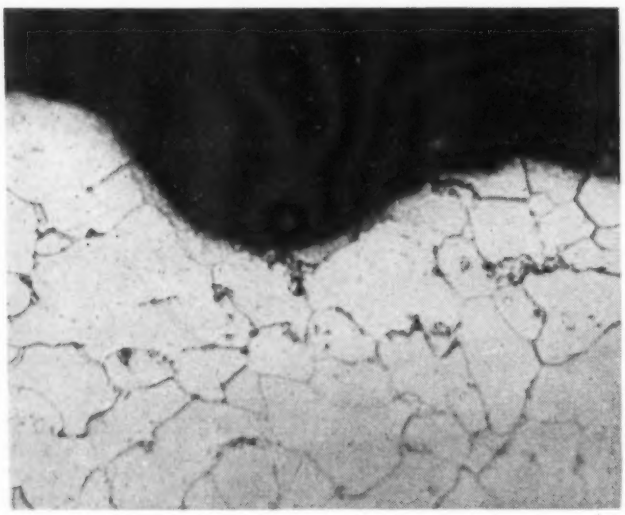


Fig. 1, above — Magnified boiler-tube section showing adhering scale. Fig. 2 — After a treatment with chemicals, scale is removed down to the clean metal surface, for maximum heat transfer to water

By L B WILSON, *Dowell Incorporated*

▶ WIDE USE of chemical solvents for removing boiler deposits pointed the way to overcoming an even older problem: ridding boiler parts of mill scale. Because it is no longer considered a surface protection, it is undesirable.

Mill scale is the term generally applied to the oxide film produced when iron and steel surfaces are heated and cooled during manufacture and subsequent fabrication. The film consists chiefly of ferroso-ferric oxide (black magnetic iron oxide). It is hard, more or less dense, usually brittle, and its thickness depends upon the thermal history of the steel (how much the steel part was heated during manufacture). Forging, bending or rolling frequently imbeds it into the surface.

If mill scale were absolutely adherent and present in a continuous film it would make excellent surface protection, and as such could be calculated into equipment design. Water conditioning would then be guided accordingly. Its coefficient of expansion, however, is different from steel so the scale checks and flakes off gradually, lodging somewhere in the circulation cycle.

If only slightly corrosive conditions exist in the boiler water, metal attack, instead of spreading uniformly over the surface, concentrates at cracks in the mill scale or on larger bare areas. Luders lines are often formed during bending of the tubes; where these lines cross, a pit may develop.

**Primary Cell.** Generally the appearance of an oxide film upon iron or steel is regarded as merely the effect of corrosion rather than a contributing and continuing cause of further deterioration. When a steel surface, covered with a noncontinuous coating of mill scale, is exposed to alkaline boiler water, the elements for a primary electric cell are present. Two dissimilar conducting substances are immersed in a conducting liquid; current is generated, and flows between the steel, as the anode, and the scale, as the cathode. Since the anode is small and the cathode large, corrosion is concentrated, Fig. 3.

**Insulation Effect.** In addition to actual metal deterioration induced by the electrolytic action of mill scale, the insulating effect of comparatively thin layers of deposit is attaining more and more importance. The modern boiler with its increased combustion rates, intricate tube arrangements and decreased water capacity, has also increased the heat absorption rates and emphasized the need for constant heat transfer. Even though the thickness is measured in thousandths of an inch, localized overheating may occur with resultant tube losses.

Actual experience has recently shown that, under certain operating conditions, periodic removal of deposits, often no thicker than the original mill scale, serves to decrease maintenance costs as well as prolong the useful life of the unit. Factual data presented at the annual meeting of the ASME in 1944[1] show the effect of small amounts of internal deposits on metal temperatures at various rates of heat absorption.

See "References" on page 8

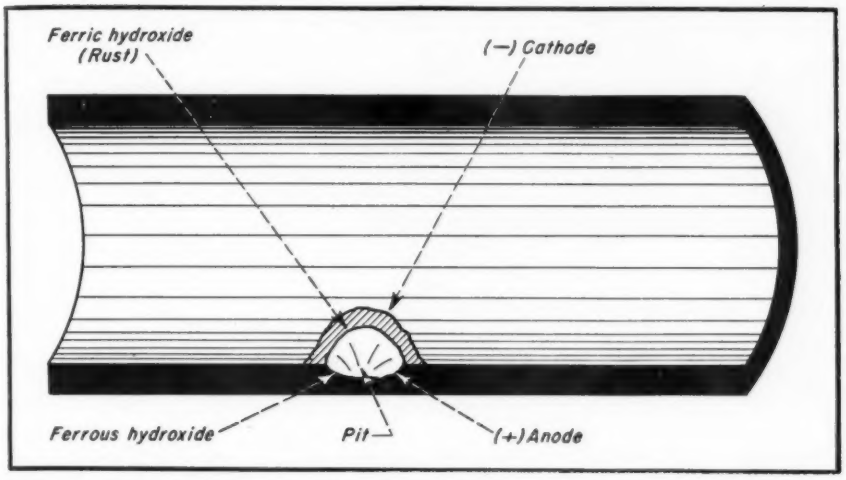



**Fig. 3—In electrolytic corrosion of metal, current flows between steel, as anode, and mill scale, as cathode. Corrosion is concentrated at exposed steel**

chemicals and rinse water, is relatively simple. While most boilers follow a general pattern for draining and venting facilities, there are individual plant details that should be worked out.

Many new installations are incorporating permanent piping when boilers are erected, as the safest and most economical method of handling the solutions, Fig. 6. Where such facilities do not already exist, temporary lines can be run from the unit to the water and chemical proportioning equipment. Concentration and temperature of the acid solvent can be controlled at the mobile equipment, Fig. 7.

Most commonly used solvent is muriatic acid because of its economy, safety in handling, and the solubility of its re-

In Fig. 5, curve *A* indicates the small inner-surface resistance offered by a clean generating tube with positive circulation. Curve *B* was obtained from the same pair of thermocouples after seven months' operation at the same rate of heat absorption. Curve *C* shows the same period at a higher rate of heat absorption. Since few plants have such an ideal method as thermocouples for observing the effect of scale formation, its magnitude is usually exposed only through tube maintenance.

All the foregoing data are well recognized but the methods of solving the problem have had no continuity and the results have been uncertain. Drums and headers are sometimes shot-blasted and the tubes individually pickled during fabrication. This should immediately be followed with a protective coating or closure against the elements, either of which can be readily removed in the field.

**Combined Cleaning.** With facilities now available for handling large quantities of chemical solvents the obvious procedure seems to be a single and final treatment of all surfaces before the boiler goes into service. The method consists of combining a modified caustic boil with a mill-scale solvent, the entire procedure being carried out in less time than is customarily spent by caustic boiling alone[3]. An alkaline solution is added while preheating the unit to dry out refractory cement, immediately followed with a prepared acid-base solvent in which wetting agents have been added to emulsify any residual grease remaining after the brief alkaline treatment.

The method, which consists of filling the vessel several times with proper

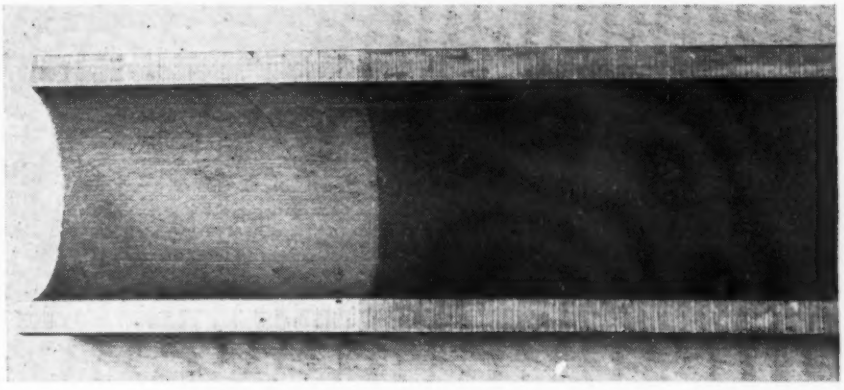


**Fig. 4—Left end of the boiler-tube has been cleaned chemically of mill scale. Complete removal reduces the possibility of premature corrosion and pitting**

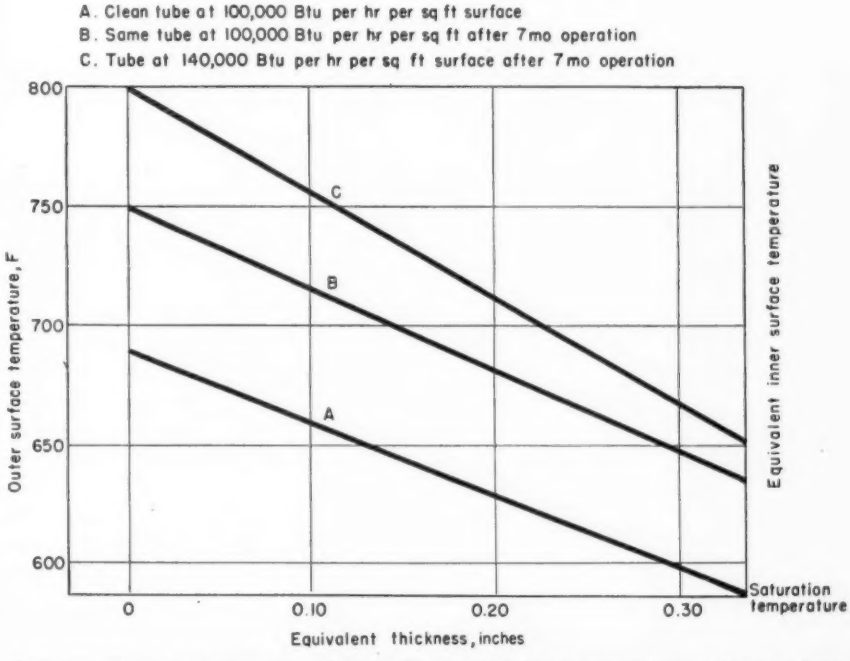



**Fig. 5—Effect of scale formation upon tube-metal temperature. Many plants observe magnitude of this effect only through the process of tube maintenance**

action products[3]. Also it is easily inhibited, a factor largely responsible for the vast improvements in the art of pickling during the past several years.

The literature on chemical cleaning is replete with data on inhibition of acids, the hundreds of materials available, and their characteristics, but for boiler cleaning the choice narrows down to a relatively few. The ideal inhibitor is one that not only retards attack on the steel to a negligible degree, but also protects ferrous and nonferrous metals used in boiler accessories. It must also be sufficiently water-soluble so that it can be readily flushed out, leaving no objectionable residues.

**Duplicate Equipment.** Equipment, designed for mixing and proportioning the acid-base solvents, is also ideal for introducing the degreasing alkaline solution, and eliminates most of the handling. The same principles, except temperature control, are involved in the acid cycle, and consist of filling the unit with the proper solution at predetermined inlet openings depending upon the design of furnace, superheater, economizer, and various superheat control devices, usually integral with the boiler.

There are several methods of chemical mill-scale removal, but experience to date has shown the following to be most practical:

1. Premix and pump the entire quantity of solution.

2. Fill the boiler with the feedwater pumps while injecting a definite quantity of strong solution into the stream at some convenient upstream location.

3. Pump a strong solution into the unit while simultaneously filling it with water. This method, while very practical for the alkaline solution, is not recommended for acid.

4. Mix the concentrated solution with water, heat and pump the mixture with mobile equipment.

As each part of the boiler, waterwall, economizer, etc, becomes full it can be either closed off or allowed to spill over into the top drum thus accelerating the filling, which is continued until the solution comes out the vent line. Sometimes a telltale pipe is run back to the truck location.

**Soaking Method.** The large volume involved, as well as the fact that a boiler is designed for thermal circulation, makes it undesirable to circulate the mixture with pumps. If they were used, the solution, following the path of least resistance, might be diverted from the generating sections to the larger external tubes and other water feeders and leave important tubes untreated.

The soaking method accomplishes a thorough job in about 4 hr, using a slight excess of acid. During this phase make careful checks on the solution to determine adjustments that may be necessary in the process. At the end of the soaking period the unit is drained, flushed with water, and treated with an alkaline solution for final neutralization. Next it is cooled and filled with water, or otherwise made ready for operation. Mill scale on a boiler tube, Fig. 4, was removed chemically. Fig. 1 and 2 are photomicrographs of boiler-tube sections, showing effective action of solvents.

Cost of the entire operation varies in accordance with the liquid capacity of the boiler. It is competitive with other methods, which are usually on a square-foot basis, because the volume is roughly proportional to the over-all area. And in calculating the cost of other methods it is necessary to consider: (1) direct factory costs for pickling and shot-blasting plus the cost of protecting the cleaned surfaces against air and moisture by painting or closure (2) cost of removing this protection, and (3) additional time consumed by the long caustic preboil normally employed.

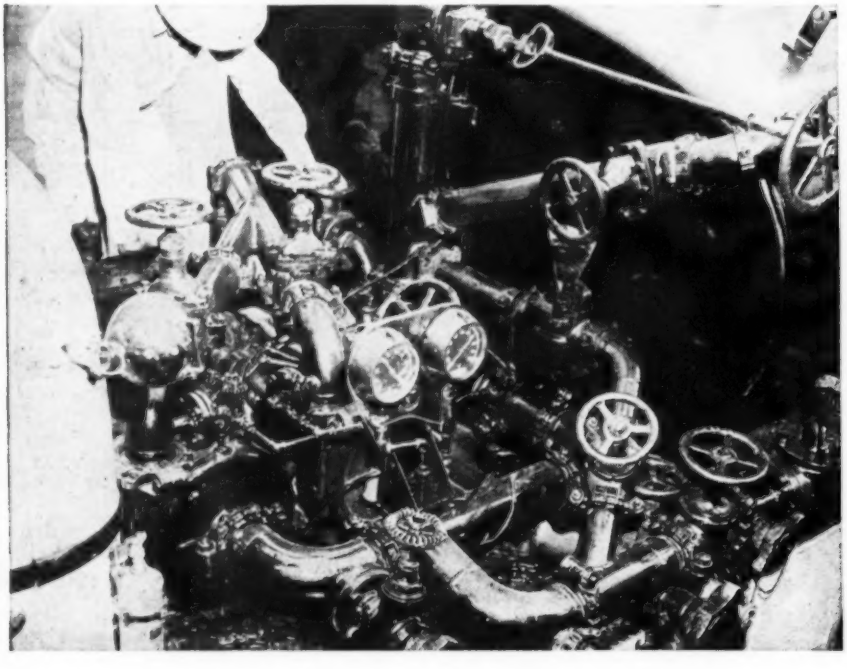
Chemical removal of mill scale offers a fast, effective method for providing a clean vessel. Designed heat-transfer rates can be attained immediately, and conditions contributing to premature corrosion removed, thus prolonging boiler life for long, useful output.

## References


[1] "The Use of Measured Metal Temperatures and Temperature Gradients of the Tube Wall to Determine the Rate of Transmission of Heat to the Fluid," by F G Ely, Babcock & Wilcox Co.

[2] "Suggested Rules for Care of Power Boilers"—ASME, 1940—p 19, pp C-42.

[3] "Chemical Cleaning Takes the Bull Work Out of Scale Removal," by E W Feller and G F Williams. POWER Sept and Oct 1946.

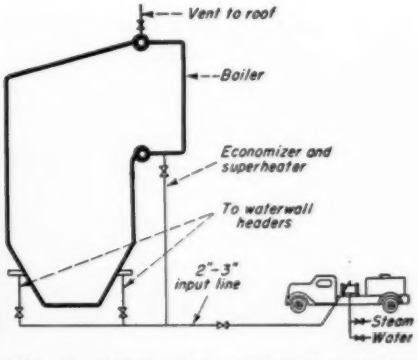



**Fig. 6, above—The permanent piping for chemical cleaning is incorporated with boiler at the time of erection**

**Fig. 7—Blending, mixing and heating of chemicals is accomplished through a pipe manifold arrangement, shown in photo. Centrifugal pumps, flowmeters and gages make control easy**

# Supercharged Diesel Puts 500 Kw In Space Originally Provided for 300

**New unit at No. 2 Park Avenue, New York, restores reserve capacity in installation marked by carefully thought out design of auxiliary systems, ingenious solution of erection problem**

▶ THE RISE in office-building load was substantial during the war years, but it was overshadowed to a great extent by the rise in industrial electrical load. Growth results largely from greater occupancy, both in terms of sq ft of space in use, and in number of persons per sq ft. This, of course, means more lighting, elevator service, etc. In addition to this factor there is the less evident but important increase in the per capita use of electricity. Not only are standards of lighting much higher than ever before but electrical office machines are more widely used today.

Experience at the well-known No. 2 Park Avenue Building, New York, a 28-story structure, shows effect of load growth. Serving this building was a 1200-kw diesel plant installed in 1936. At that time, greatest maximum demand was 900 to 950 kw, which permitted operation with one of the four 300-kw units in reserve. By the winter of 1946-47, maximum demand had reached 1387 kw. Expressed another way, peak load on the plant, which couldn't be enlarged during the war years, was running 5000 to 5500 amp against 4800 amp nominal capacity. For several years the plant necessarily operated without any effective margin of reserve.

### Engineering Recommendations

As soon as V-J Day arrived, the management asked Edgar J Kates, consulting engineer, to investigate and report on adding another unit. He recommended as much capacity as the space would allow. The original design provided for addition of a duplicate unit of 300 kw. But by taking full advantage of improvements in engine design since 1936, it was possible to put 500 kw in the space originally intended for 300. How this was done, together with some of the problems involved, can be visualized best by reviewing briefly the layout of the 1936 installation.

Use of oil-fired boilers in a building designed with a coal pocket provided space for a power plant. At one side of the basement, this space was partly under the sidewalk and partly under a delivery ramp leading from the street down to a basement loading platform. The four original engines were Worthington 6-cyl 327-rpm 13¼x17-in. 450-hp 4-cycle solid-injection engines direct-connected to Crocker-Wheeler 300-kw 250-v dc generators. The four units were arranged in groups of two at one end of the space, as in the sketch, Fig. 2, and the photo, Fig. 1. A foundation block for a duplicate engine-generator was provided in a separate space, as shown.

Design changes in Worthington engines of this model permitted raising operating speed to 360 rpm and boosting output by turbocharging. The combined effect of speed change and supercharging was to increase capacity by more than 60% (from 300 to 500 kw) without changing the physical dimensions of the engine. The new engine, a Worthington SDD-6, is rated at 740 hp, at 360-rpm 1050-fpm piston speed and 112.5-psi bmep. Pistons in the 13¼x17-in. cylinders are cooled by oil spray. The diesel drives a Crocker-Wheeler 500-kw 250-v compound-wound 2-wire dc generator. Guarantee and test performance figures for engine and generator are given in the Table.

### Cooling-System Design

Because the original cooling system, of the closed type with a forced-draft cooling tower on a roof balcony, did not have sufficient spare capacity for the new engine, it was decided to install a completely independent system. Cost of additional pumps and piping ruled out another roof cooling unit; use of evaporative coolers, elsewhere than on the roof, involved vapor-removal difficulties.

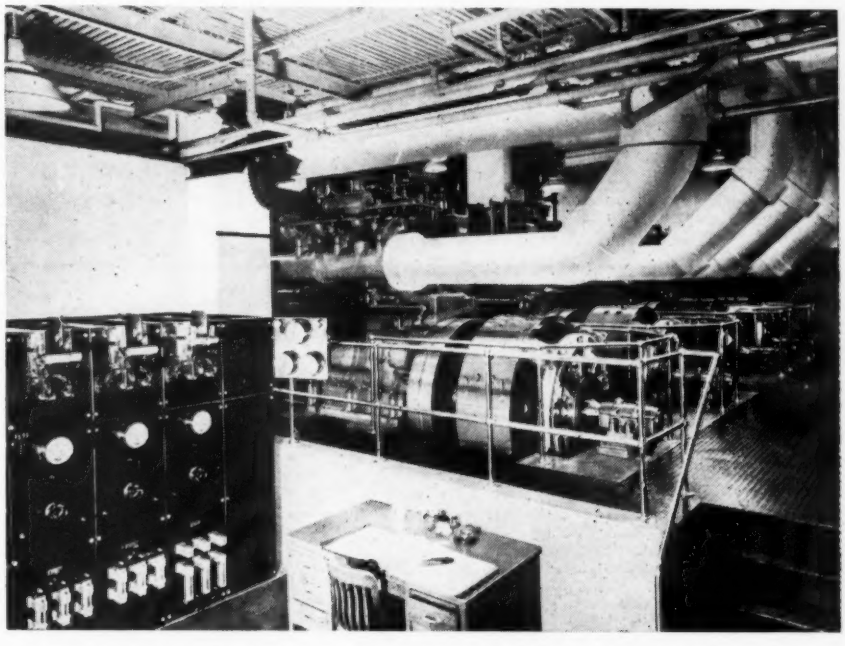
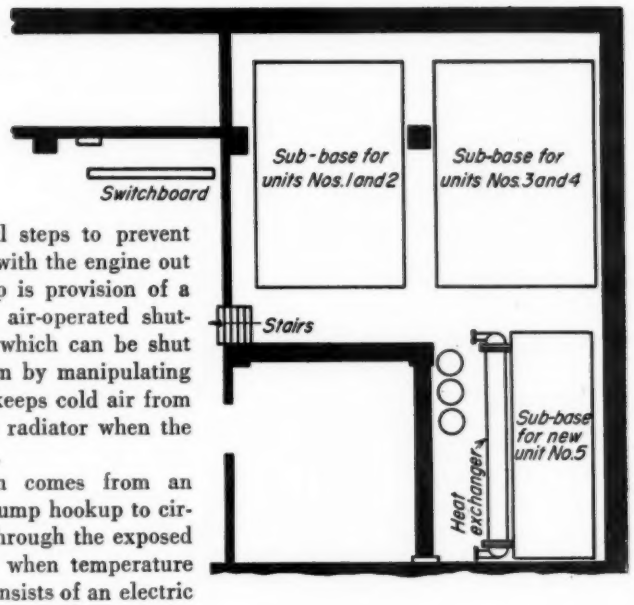


Fig. 1—View of existing switchboard and 300-kw engine-generator sets

Fig. 2—Sketch plan shows general layout of the machinery space in basement of No. 2 Park Avenue Building, with sub-bases for the four existing units and for new Unit No. 5




Therefore a dry radiator was installed in the air space above the ramp and loading platform; the Young unit selected includes an oil-cooler section and has a 93-in. 6-blade aerovent fan.

In normal practice, adjusting the radiator shutters or regulating the water flow would serve to control cooling. Operation on dc made it possible to control fan speed, with shutters wide open while the fan is running and waterflow constant for full circulation, a more satisfactory scheme. Designed to cool 320 gpm from 150 to 140 F, with 85 F ambient, the system provides capacity even for 100 F ambient, since engine temperature can be carried to 165 F.

### Fan-Speed Control

Control of fan speed is obtained with standard adc motor, which, with field control, has a speed variation of 2 to 1 (850 to 1700 rpm) with fan delivery in proportion. To take care of winter conditions and light loads, even slower motor speed than 850 was desirable. This was obtained by arranging the motor switching so that while maintaining the field on 240v c, the armature could be thrown to one of the 120-v legs of the system, which dropped speed again by 2 to 1 (850 to 520 rpm).

To provide alarms for high temperature and low pressure on the cooling-water circuit, and also on the lube-oil, an existing Edwards annunciator system was utilized, with new Detroit Lubricator switches for pressure and temperature. An Alnor distant-reading electric thermometer in the engine room shows water temperature, permitting the operator to check radiator conditions at all times, even with water not circulating.

To avoid air pockets when starting up, it is desirable to keep the water system full even when the engine is shut down. This requires special steps to prevent freeze-ups in winter with the engine out of service. First step is provision of a manually controlled air-operated shutter on the radiator, which can be shut from the engine room by manipulating a 3-way cock. This keeps cold air from blowing through the radiator when the engine is shut down.

Further protection comes from an electric heater and pump hookup to circulate warm water through the exposed piping and radiator when temperature is low. This setup consists of an electric heater, with three General Electric elements totaling 13.5 kw. It is connected to be switched either in series or in parallel to give three different degrees of heating. The heater connects in series with a Worthington 1-in. ½-hp circulating pump. To reduce amount of heating required, exposed piping is insulated with 2 in. of hair felt. As a further safeguard against failure of the operator to cut in the heater, a low-temperature contactor in the radiator sounds an alarm in the engine room if water temperature drops to 40 F.

The main pump in the cooling-water system is a Worthington 1750-rpm 10-hp 3-in. centrifugal. The system is valved to run three ways: (1) using pump and radiator, which is normal, (2) pump plus city-water recirculation to maintain the desired temperature with radiator out, and (3) city water only, with both pump and radiator out and a high temperature rise.

The new engine, like the existing units, has a full-pressure lubrication system with a gear pump on the crankshaft. Normally, this delivers to the oil section of the radiator, which is under pressure, there being no expansion tank, and thence to the oil pressure manifold of the engine. The crankcase drains to a 300-gal sump tank below the floor, from which the oil pump takes suction.

Temperature control in the lube-oil system is inherent; in cold weather or at light loads, the fan runs slow to maintain desired water conditions. Thus the controls for the water system normally serve for the oil circuit, but a hand-operated bypass is provided around the radiator oil-cooling section.

When the engine shuts down, the radiator section and the engine drain to the sump tank, which eliminates danger of oil thickening in the radiator overnight. For starting up, immediate oil circulation is desired. A solenoid valve at the engine is controlled by a pressure contactor in the line from the oil cooler to the engine. If there is no pressure, the valve is open and oil goes direct from the engine pump to the engine manifold. Surplus oil starts to rise in radiator lines and builds pressure, closing the valve and establishing the normal circuit through the radiator cooling section. To avoid air pockets, the oil system is provided with two Apco vent valves to release air. These drain back to the sump.

### Lube-Oil Purification

Lubricating-oil condition is maintained by a Honan-Crane purifier with a heater, the unit being connected for continuous-bypass operation. A full-flow Schutte-Koerting filter is installed on the engine lubrication system. A Zenith filter protects the fuel-oil system.

Air supply comes from the engine room; a Vortox filter-silencer is in-

## GUARANTEE AND TEST PERFORMANCE OF DIESEL ENGINE AND GENERATOR

| | | | | | |
|---|---|---|---|---|---|
| Load, % | 0 | 50 | 75 | 100 | 110 |
| Engine output, bhp | 0 | 370 | 555 | 740 | 814 |
| Exhaust temperature F* | 280 | 540 | 630 | 725 | 780 |
| Temperature after supcharging, F | 240 | 450 | 540 | 610 | 660 |
| Test fuel rate, lb per bhphr | .... | 0.371 | 0.366 | 0.366 | 0.381 |
| Guaranteed fuel rate, lb per bhphr | .... | 0.380 | 0.375 | 0.375 | ..... |
| Test-generator efficiency, % | .... | 93.7 | 94.2 | 94.2 | 94.0** |
| Guaranteed generator efficiency, % | .... | 93.7 | 94.1 | 94.0 | 93.7** |

*Average of cylinder outlet temperatures. ** At 125% load.

stalled at the intake of the Elliott turbocharger. Between the crankcase and inlet manifold there is an Air Maze crankcase vent. Engine exhaust goes through a Worthington-designed 3-part watercooled manifold to a Maxim silencer. When the original installation was made, a 10-in. nozzle was provided in the 24-in. manifold leading to the boiler breeching and the stack. This was replaced with a 14-in. nozzle to accommodate the larger gas flow from the larger engine. The exhaust system is suspended on spring hangers and fitted with a United Metal Hose flexible connection. The Alnor exhaust pyrometer has a 10-point selector switch with one point for each cylinder, one at each of three turbine inlets and one at the turbine discharge.

Starting air for the new engine comes from the existing system. A new 100-gal day tank, with level indicator, was installed to supply the new engine from the existing fuel-oil system. A central gage board for the new unit mounts the distant-reading thermometer, the exhaust pyrometer, five pressure gages, and an altitude gage, which shows when cooling-water level in the expansion tank is above the radiator.

### Vibration Isolation

The sub-base originally provided for the new engine was 18 in. thick, on piers going down to solid rock; its surface was 3 ft. 6 in. below the engine-room floor. On this was installed a floating block carried on 12 Korfund vibrodampers. It was designed with girders and box construction around the generator pit. The vibrodampers support the beams, which in turn support the block.

Electrical layout for the original plant provided for a fifth unit. Since it was expected to be only a spare, bus duct and switchboard were designed for four units (4800 amp). In adding the new units it was decided to allow for running all five at full load (6800 amp). Further change was necessitated by the fact that the blank panel was at the wrong end of the board, the beginning.

It was thus necessary to provide an entire new bus behind the board, mounted overhead instead of behind, and also to parallel the bus duct from the switchboard to the building panel with another bus duct. A new panel was installed and the new bus system connected to both old and new bus ducts. All work was done with the plant operating, except the final connections, which were made in 12 hours on a Sunday, while the pipe fitter made his final hookup.

The installation of the engine generator and silencer presented an unusual problem because of their size and weight and the difficulty of access to the basement plant. The only practical means of access was obtained by cutting a hole in the ramp leading down from the street to the loading platform. Only half of the ramp could be used for this purpose, as traffic had to be maintained. Within limitations of girder spacing, the largest hole that could be cut was about 6 ft, 6 in. by a little over 10 ft. Installation procedure was worked out in comprehensive detail by Consulting Engineer Kates, using scale-size templates. Rigging was done by R Doughty Sons Co, of New York, and while clearances were almost nonexistent, the equipment was put in place without a hitch. The step-by-step procedure is shown in diagrams and action photos on pp 98, 99 of this issue.

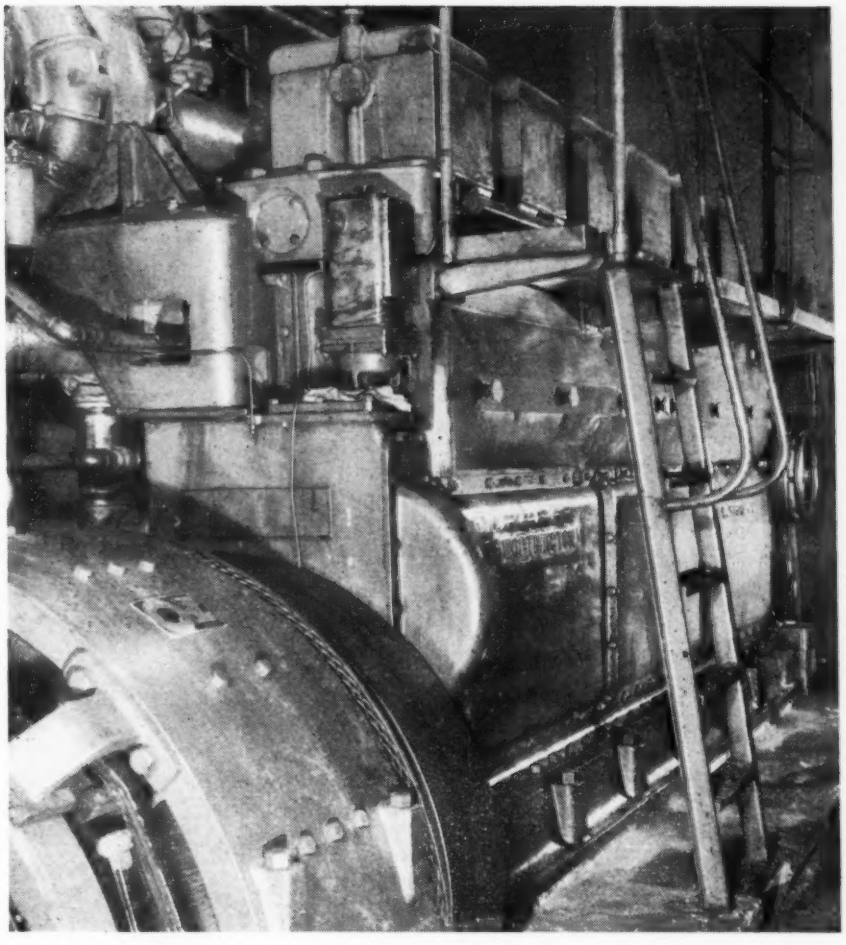


Fig. 4—Supercharged new unit, at 360 rpm instead of 327, generates 500-kw but fits sub-base designed for 300-kw machine. Guard rails not yet installed

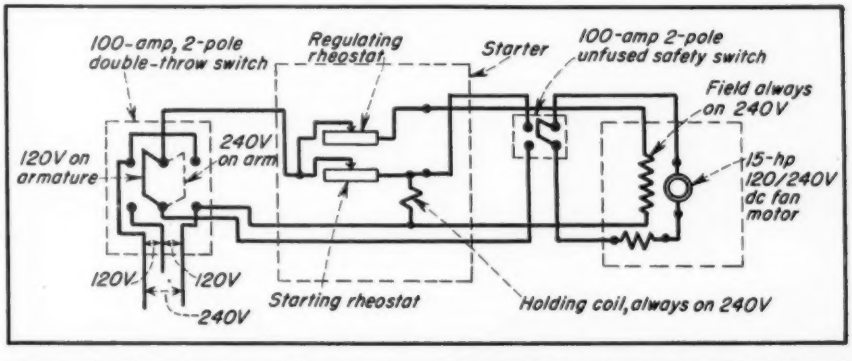



Fig. 3—Wiring for fan motor on new unit's radiator shows how 4-to-1 speed range was obtained with standard dc motor by field control, switching armature

# Correct Materials Make Feed Pumps Immune to Corrosion-Erosion

**Best feedwater for boilers is the worst for feed pumps. H L Ross, chief engineer, centrifugal pump dept, Allis-Chalmers, gives six causes of corrosion-erosion in these pumps and tells how to eliminate it in carbon-steel pumps now in operation***

▶ UNTIL A FEW YEARS AGO carbon steel was acceptable material for casings of high-pressure boiler feed pumps. This practice continued in spite of occasional trouble due to corrosion-erosion of the fits between stages and high-velocity passages, as indicated on the cross-sectional drawing. The trend in feedwater treatment, however, has been toward supplying the best water for the boiler with little regard to its suitability for feed pumps and valves. Thus, new problems have been created for pump designers.

These problems have been the object of intensive study by a joint committee of pump-manufacturer and public-utility engineers. They have assembled sufficient information to give assurance that these difficulties will be eliminated in new pumps. A paper, "Corrosion-Erosion," by Wagner, Decker and Marsh of the Detroit Edison Co, presented at the ASME December 1946 meeting, deals primarily with the life of various materials. Possible remedies for trouble in carbon-steel pumps now in operation are discussed in the following, and various materials are compared from a practical standpoint. Something has been learned of the causes of corrosion-erosion, and suggestions are made for their reduction or elimination. Let's look at six causes and then at their remedies.

Causes of corrosion-erosion are:

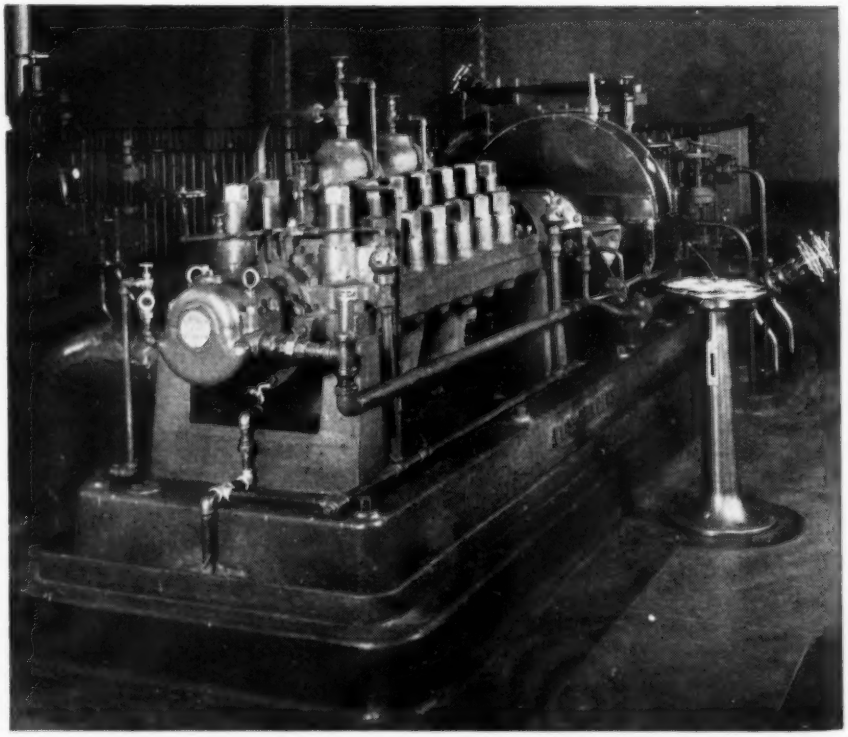
**Operating Conditions.** A study of such factors as capacity, pressure, temperature and method of drive seems to indicate that these factors have little bearing on corrosion-erosion. But there does seem to be evidence that high temperature is conducive to this trouble.

**Feedwater.** Of several factors—pH value, oxygen content, amount of solids and use of chemical feedwater treatment—pH seems the most significant. It appears that the higher the pH value, the less chance of trouble with carbon-steel pump parts. For instance, where pH is above 9.0 there is only one chance in five of trouble, whereas there are indications that three carbon-steel pumps out of four will give trouble with pH below 8.

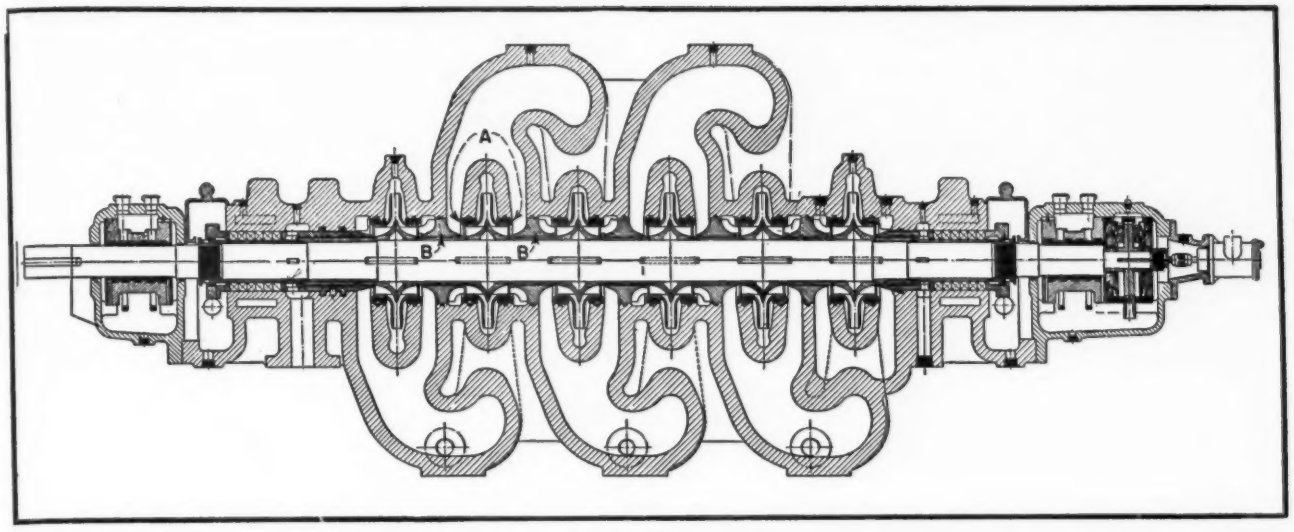
**Sodium Sulphite.** Addition of this chemical either ahead of the pump or directly into the boiler may possibly lead to trouble, even though the results are not conclusive. But it seems that sodium sulphite causes more trouble where pH is below 8.5. It makes little difference whether it is introduced ahead of the pump or directly into the boiler. The theory is that it decomposes in the boiler into $H_2S$, and is carried over in the steam to reduce the condensate's pH value. Where pH is held above 8.5 the use of sodium sulphite does not seem to increase or decrease pump trouble. General results with this chemical are so inconclusive that it must be used with caution.

**Cavitation.** A study of various pump failures indicates that cavitation is not a factor. This phenomenon, associated with a liquid that vaporizes and then collapses, causes a combined mechanical and chemical attack. It is, therefore, associated with low-pressure areas in a pump while the difficulties under

* Based on a paper presented before the Midwest Power Conference, at Chicago, Ill., Mar 31 to April 2, 1947.



**Boiler feed pump for 1500-psi discharge pressure in casing of carbon steel, an acceptable material for high-pressure high-temperature pumps for many years. Other alloys are now replacing it because of corrosion-erosion difficulties**




Corrosion-erosion occurs in casing volutes, in casing fits adjacent to wearing rings (A), and at shaft bushing fits between stages (B). Nickel cast iron, chrome steel and other materials are eliminating these problems

discussion occur just as frequently in high-pressure stages, where vapor cannot form, as in low-pressure stages.

**Pump Design.** Corrosion-erosion occurs in one design of feedwater pump as often as it does in another. It is associated with high liquid velocities, but it is impossible to design a pump with velocities low enough to avoid the attacks.

**Workmanship.** This factor seemed to influence the start of corrosion-erosion, particularly where interstage leakage occurs. Poor machine work leads to initial leakage, which starts erosion of cast steel. If the material is susceptible to attack, however, the pump usually fails later in another part, such as the casing volutes, which are subjected to high velocities. When leakage occurs behind a bronze ring the carbon steel may erode rapidly but with no measurable wear on the bronze part, which is a softer material and subject to the same velocity. This would indicate a chemical rather than a mechanical action.

When this trouble was first encountered in volutes or casings, it was attributed to poor steel castings, particularly sand inclusion on the surface. To check this difficulty, a carbon-steel-plate volute liner was installed, but it was attacked as badly as the less-dense carbon steel. In this installation the pH was raised to 9.0 by recirculating boiler water, but with little if any reduction of the trouble. When the pH was raised to 9.5 the attacks ceased entirely with both the steel casting and steel-plate liner. Subsequent changes to 18-8 stainless-steel fits between stages and liners eliminated the trouble even without recirculation.

Remedies for corrosion-erosion are:

**Feedwater Conditions.** There are no ironclad rules for avoiding corrosion-erosion with carbon-steel parts. In general, however, it is advisable to keep feedwater pH above 9.0 or 9.5 by recirculation, or by the addition of caustic, and to eliminate sodium sulphite. It may also help to alternate the pumps in service on the theory that an idle pump builds up a protective film, which gives it some protection during operation.

**Protective Coating.** Existing pumps may have the fits between stages built up with 18-8 stainless steel or other stainless alloys, and have the volutes lined with similar material although this is an expensive process, which usually requires sending the pump to the factory. Use of a coating of baked-on bakelite lacquer is reported in the Wagner, Decker and Marsh paper. This coating, only 0.0003 in. thick, was practically unattacked after a 500-hr accelerated test. It may be difficult, however, to apply the coating to close running surfaces and keep it intact during assembly.

**Materials.** A more logical and positive solution is to use materials that stand up under practically any feedwater condition. It appears that a 5%, or better, chromium steel does this, but other factors may make another material better for a particular installation. The table compares the characteristics of some of the most commonly used materials.

**Cast Iron.** Nickel cast iron, listed in the table, has fair resistance to corrosion. Detroit Edison tests indicate that ordinarily cast iron is about three times as resistant to corrosion-erosion as cast steel, but our experience with 1% nickel cast iron shows it to be much better than that. With temperatures up to 400 F and pressures up to 1200 psi, 1% nickel cast iron has not failed because of corrosion-erosion. This is true even where carbon-steel had been attacked. One steel-casing heater-drain

## COMPARISON OF MATERIALS FOR BOILER FEED PUMPS

| | *Nickel cast iron* | *Carbon steel* | *4–6% Chrome* | *12–14% Chrome* | *18–8 Stainless* | *25–20 Stainless* |
|---|---|---|---|---|---|---|
| Corrosion resistance to feedwater | Fair | Poor | Good | Good | Excellent | Excellent |
| Tensile strength | 50,000 | 70,000 | 100,000 | 110,000 | 75,000 | 75,000 |
| Resistance to shock | Poor | Good | Good | Good | Excellent | Excellent |
| Coeff of expansion X $10^6$ | 6.0 | 5.6 | 5.5 | 5.5 | 9.0 | 9.0 |
| Heat treatable | Yes | Yes | Yes | Yes | No | No |
| Weldability | Poor | Good | Fair | Fair | Excellent | Excellent |
| Machineability | Excellent | Good | Good | Good | Difficult | Difficult |
| Initial cost | Low | Moderate | Moderate | High | High | Very high |

pump operating at 400 F failed in a few months, where a cast-iron casing substituted in emergency has operated three years without trouble. Generally cast iron is limited to 1000 psi, but we normally sell feed pumps of this material for pressures below 1000 psi unless it has proved unsatisfactory.

**4-6% Chrome.** So far we have not heard of any failures of this material even after 50,000 hours of service, but it has not been used in casings long enough for full evaluation. Detroit Edison tests indicate that it is 75 to 100 times as resistant as carbon steel. It casts and machines just about as well as carbon steel.

Chief disadvantage is that it is difficult to weld. It can be welded quite satisfactorily under proper control, which requires preheating to 800 F, welding hot, and then immediately annealing at 1350 F. If this is not done, hard spots develop around the weld area along with a tendency to crack.

**2-3% Chrome.** Detroit Edison tests included samples of 2 and 3% chrome, which performed about as well as 5%. Since these tests were made on only one feedwater, we do not feel that this material can be relied on under all conditions, but tests show 5% chrome has a good margin of safety.

**12-14% Chrome.** This material has about the same advantage and limitations as 4-6% chrome. It does not cast as well, being subject to hot cracking, but is excellent for parts, such as shaft sleeves, wearing rings, etc. We use this material heat treated to 350 Brinell for impeller wearing rings with a higher carbon material heat treated to 500 Brinell for casing wearing ring.

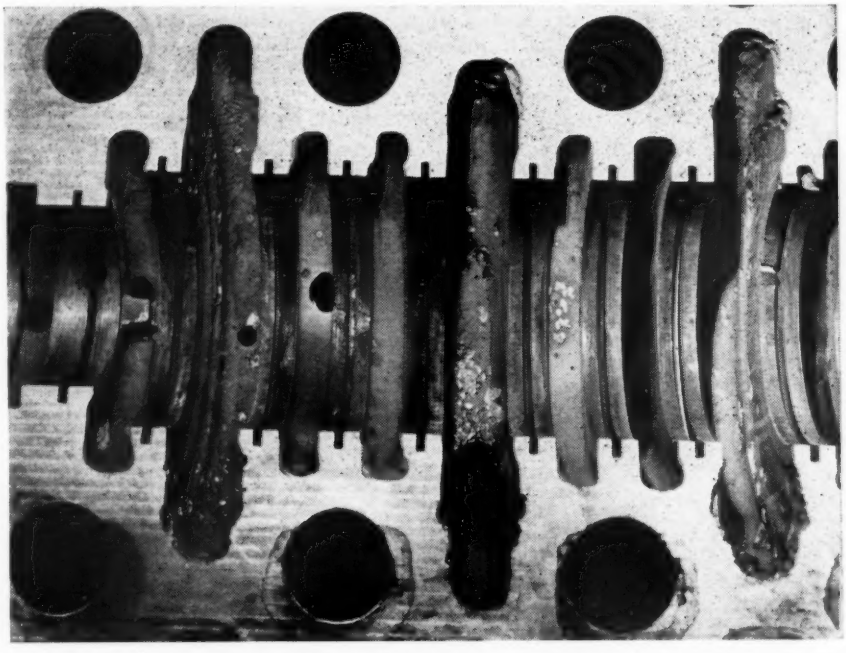
**18-8% Stainless Steel.** This material on laboratory test seems to be about five times as resistant as 4-6% chrome steel. It has the advantage of being easily cast and welded, requiring no preheat or subsequent annealing. Its principal disadvantage is that it is difficult to machine, particularly to drill and tap.

**Parts Materials.** For impellers we have found monel a highly satisfactory material, being resistant to all feedwaters so far encountered. It is readily cast and machined. Bronze is satisfactory except for high pH water, although it has the disadvantage of a high coefficient of expansion. For wearing rings, bushings and shaft sleeves, different hardnesses of stainless steel of the 12-14% chrome grade have been highly satisfactory.

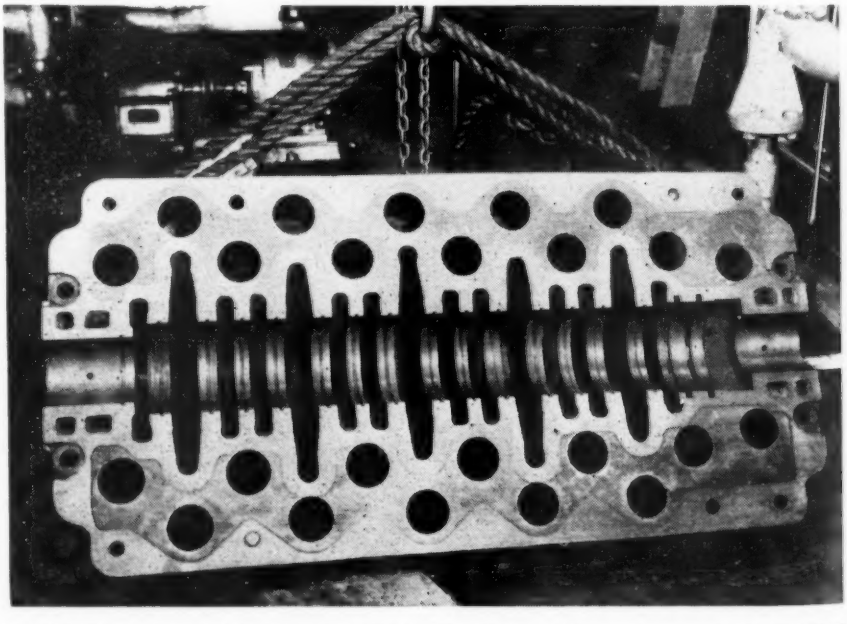
**Conclusion.** Prevention of corrosion-erosion in new feed-pump installations seems to lie in the direction of materials that stand normal water conditions. It is difficult to control feedwater, particularly as to pH and oxygen content, to assure a favorable water to the pumps. Furthermore, all feedwater control is pointed toward maintaining the best condition in the boilers.

For these reasons it is impossible for the pump manufacturer to guarantee that pump materials are suitable for feedwater in a particular installation. General practice is to guarantee that the materials will be furnished in accordance with contract specifications. Furthermore, the user takes responsibility for feedwater conditions and for selection of the pump materials.

To avoid corrosion-erosion with present pumps, the rules outlined may be helpful. For new installations purchase pumps constructed of materials not susceptible to feedwater attacks. The additional cost of such pumps is justified by their increased reliability and lower maintenance costs.



Carbon-steel casing for high-pressure high-temperature feed pump shows corrosion-erosion of volutes, wearing-ring, interstage bushing fits after 8000 hours



High-test nickel cast-iron casing for high-pressure high-temperature boiler feed pump after 8000 hours' operation shows practically no corrosion-erosion

# Can You Specify What You Want?

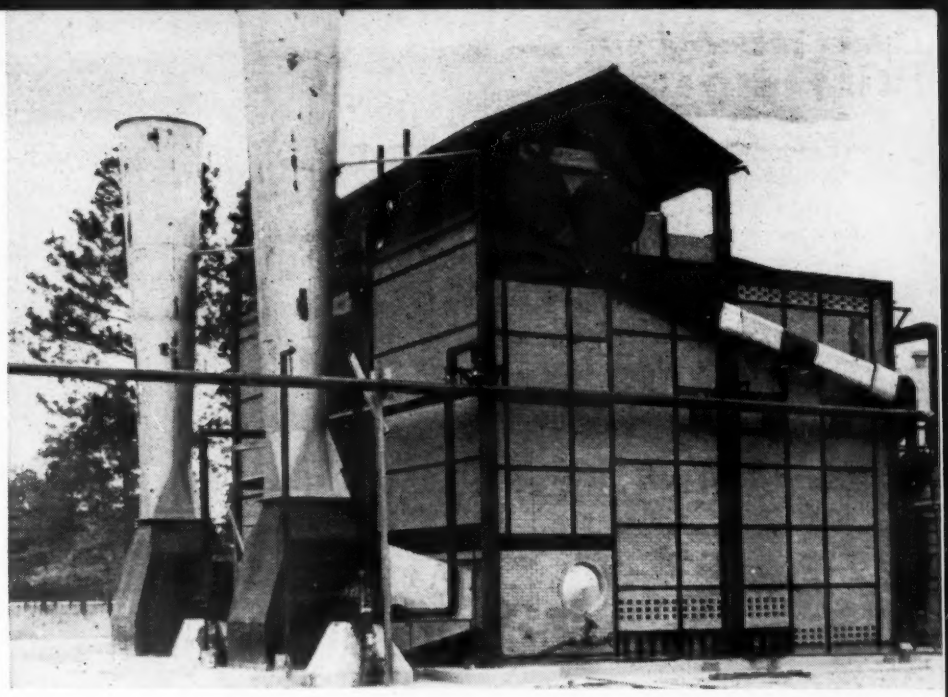


Fig. 1—Outdoor boiler satisfactorily installed in record time demonstrates the results of good specifications

**A good 'spec' is essential in getting equipment that is exactly what you want. R H Emerick, consulting engineer, tells how to write specifications, gives wording of important paragraphs**

▶ WRITING A SPECIFICATION is a task that most engineers undertake with considerable regret. Nevertheless, a good "spec" is a valuable device for keeping everyone concerned out of trouble. It determines equipment received and governs the money spent; therefore build your specs with care.

Consider, for example, the legal time bomb that was included, but not named, in the winning bid for some water-treating apparatus. Here the successful bidder was being sued for infringement of a basic patent. He felt so confident of winning the suit that he saw no reason to tell the prospective buyer that he, too, might become involved. In fact, when the purchaser discovered the situation, the bidder thought him quite old womanish because he insisted on recalling the specifications and adding a clause worded approximately this way:

"The Contractor shall be responsible for any and all infringements of patent rights on any and all appliances used, or on any design or detail, or device entering into the construction of the equipment specified hereunder, or that may be used by the Contractor in the prosecution of this contract. The Contractor, moreover, shall guarantee to save the Purchaser harmless from all loss by injunction, suit or both, and shall provide a surety bond for this purpose if requested by the Purchaser."

Some months later, the successful bidder lost the suit and was obliged to pay damages and royalties as the aftermath of having an over optimistic legal department. The purchaser, however, used his new water-treating apparatus without strings. His new plant was a good one, well worth the added paragraph.

**Scope of Work.** Specifications are intended to set forth construction responsibility as well as legal. For this reason an opening paragraph, entitled "Scope of Work" or "Description of Work," is desirable. A typical paragraph runs something like this:

"This specification is intended to cover the furnishing, delivery and erection of a 10,000-kw turbine-generator set, together with all appurtenances directly part of either the turbine or the generator and needed for the successful operation of the unit. The foundations will be furnished by the Purchaser, but outline drawings of the equipment and loads to be imposed, as well as any other important or pertinent data, shall be furnished by the successful Bidder."

Sometimes the scope of work calls for a complete plant, but more often than otherwise covers only items like turbines, boilers and pumping equipment. Such specification should always be worded so that bidders cannot interpret the paragraph other than intended.

**Risks, Permits and Laws.** It is poor policy to discover after a job has been started that permits are missing, or that in some way the proposed work violates existing laws or ordinances. The only sure way to avoid trouble from this source is to place the responsibility definitely. If placed on the bidder a suggested paragraph shapes up as follows:

"The Contractor shall assume all risks for accidents and damages to persons and property, until the work under this contract is completed and accepted. He shall obtain all necessary permits and licenses prior to commencing the work, and shall undertake to observe all rules, regulations and ordinances in effect during the conduct of the work, and shall save the Purchaser harmless as the result of any infractions thereof."

The purpose of this paragraph is not to place a burden on the bidder, but rather to charge with responsibility a person who is normally most familiar with such restrictions through the nature of his business. This plan seems to work out very well; there is seldom any need for worry when it is adopted.

**Signature of Contracts.** Not often do we worry about the name on the dotted line. But there are times when it is wise to specify in the proper places the autographs of president, vice-president, owner or similar authority—for in-

stance, when dealing with a newly formed organization or with one not too stable financially. Later, if the contractor or successful bidder encounters internal reorganization or financial difficulties any question of corporate responsibility for carrying out the terms of the contract is less likely to receive an unfriendly answer. Inspection of the bidders' contract forms is desirable before completing the specification. This examination indicates how much responsibility the bidder intends to assume as a matter of general policy.

**Equipment Particulars.** This paragraph tells the bidders EXACTLY what is wanted, and I write *exactly* in capital letters. You must not permit bidders to guess or approximate because no two coincide in their assumptions. Bids will not be exactly alike despite their superficial appearance of similarity.

In a U. S. Navy Yard, for instance, bids were asked on refrigeration compressors to deliver about 35 tons when operating at approximate speeds of 650 rpm. When bids came in, one was so high that the bidder was thought to have misinterpreted the specification, and was asked to explain. He explained all right; in fact, his explanation showed that the other bidders had undersized their equipment. Bids were accordingly thrown out; the specification was re-issued with the approximations deleted, and a new paragraph added to cover volumetric displacement. The revised form called for a minimum of 35 tons at a maximum compressor speed of 675 rpm. It also required all bidders to submit data on the volumetric displacement of the machines offered.

In this case, undersizing of equipment was deliberate. It was an unethical shenanigan to obtain the business, and the word "approximate" was at once an invitation and a permit to the practice. Fortunately this sort of thing does not occur frequently, but mistakes by bidders can become sorrowful contracts for all concerned. One of New York's outstanding engineering organizations requires its member engineers to check the theoretical ability of every low bid to accomplish the ends intended. The firm considers the time so spent thoroughly justified.

One public utility company calls for volumetric statements from bidders on all compressing equipment. Here follows an extract from one of their specifications that was used satisfactorily to buy an air compressor. Quotation was taken from section on "Preliminary Drawings and Data":

"The Bidder shall also fill in the tables [Fig. 4 and 5] and submit same with his quotation."

There is no misunderstanding possible when tabulations of this kind are included in a specification.

Detailing in a specification is weary

Fig. 2—Specifications for this radiant-heating system stated where and how pipes were to be laid and gave minimum floor thickness as well as other details

Fig. 4 — Below: Typical table for submitted data in specifications for an air compressor. Tabulated data become part of the contract

| Gpm | Water temperature, F | Total press psig | Total steam* lb per hour | Turbine Bhp | No. of jets, constant | Rpm |
|---|---|---|---|---|---|---|
| 300 | 175 | 525 | | | | |
| 500 | 175 | 525 | | | | |
| 700 | 175 | 525 | | | | |
| 1000 | 175 | 525 | | | | |
| 1250 | 175 | 525 | | | | |
| 300 | 236 | 525 | | | | |
| 500 | 236 | 525 | | | | |
| 700 | 236 | 525 | | | | |
| 1000 | 236 | 525 | | | | |
| 1250 | 236 | 525 | | | | |
| 300 | 100 | 525 | | | | |
| 500 | 100 | 525 | | | | |
| 700 | 100 | 525 | | | | |
| 1000 | 100 | 525 | | | | |
| 1250 | 100 | 525 | | | | |

* In all cases the steam conditions are 375 psig, 675 F, and backpressure is 18 psia.

| Load % | Piston displacement c f m | Volumetric efficiency % | Free air c f m | Hp to drive | Discharge pressure psig |
|---|---|---|---|---|---|
| 0 | | | | | 100 |
| 25 | | | | | 100 |
| 50 | | | | | 100 |
| 75 | | | | | 100 |
| 100 | | | | | 100 |

Fig. 5—Right: Table included under heading of performance and guarantee for a steam-turbine-driven boiler feed pump. The specifications state that each bidder shall fill in and submit with his proposal the information requested in this tabulation. If accepted by the purchaser this information forms a part of the contractor's guarantee. It also gives data for evaluating bids

Fig. 3—Finished schoolroom, shown under construction in Fig. 2. Occupancy followed immediately after completion because there were no unfinished parts

business; yet missing out on a single point may seriously impede construction progress. Suppose the specification of a school radiant-heating system had failed to note that a sinuous coil, Fig. 2, was to be used in the lavatory area, or that the straight pipe grids were to be arranged longitudinally. If it had left floor thickness and the center-to-center distance of the pipes to the individual bidders there might, with reason, have been complaints about unfair competition.

If a bidder telephones or writes, asking permission to deviate in any detail from specifications, it is an allowable and sometimes expected procedure. If, however, the inquirer wants more information on what the purchaser is trying to buy, someone should hang his head because the specification is incomplete or ambiguous. In fact the purchaser might as well admit failure on one of the most important responsibilities of his job.

**Location.** Who would forget to tell a bidder where new equipment is to go? The answer is nobody—if you consider the name of the town as the whole story. A bidder, however, likes to know when he must lug his product to a third or tenth floor. He also likes to know the weights involved, and whether special-handling equipment is needed. Specifications should set down methods of access to the site of the work: whether a railroad siding is available, or material must be brought by boat or trucks, or by a combination of these two. Elevators and cranes are an asset, because if rigging has to be furnished, up goes the price. Bidders will ask about these items if not told, but the purchaser is responsible for putting out the information in the first place.

**Guarantees.** In this paragraph set down precisely what guarantee of performance a bidder must make. Probably the information has appeared elsewhere in the specification but, nevertheless, include a paragraph dealing with guarantees exclusively. This is a safeguard against their being overlooked. Fig. 5 shows a sample form, which becomes a part of the guarantees.

**Price and Time.** These two items belong together, because failure to complete many jobs by a predetermined time brings a penalty to the contractor. On the other hand, early completion may earn him a bonus. The time factor should be clearly delineated in every specification so no misunderstanding can occur.

As for price, one factor of importance, which prospective purchasers sometimes overlook, is the desirability of having all quotations fob point of delivery. For instance, an organization purchased a boiler together with its appurtenances and oil burners of the burned steamship, *Morro Castle*. The boiler was taken out of the hull at Baltimore, Md., the price being based on point of delivery, Hoboken, N. J. En route, oil burners and several gages were stolen. The seller was responsible for delivery, and had no choice but to replace the missing equipment.

**Information and Drawings.** If you want to know what you are really getting for your money, ask bidders to furnish data on the physical sizes, weights, materials and other important characteristics of the equipment offered. Study of these data may reveal some startling facts. For instance, after a public utility company, had placed an order for three steam turbines of new design to drive plant auxiliaries they found that the turbines could not be started. They were designed to stop in the event of low oil pressure, a very good feature of course, but unless the turbine was running there was no oil pressure at all. The manufacturer felt a trifle silly, but was grateful that his mistake was caught before the turbines were delivered.

In asking bids on equipment, such as the outdoor boiler installation with a canopy roof, shown in Fig. 1, have bidders furnish all dimensions and

(*Continued on page* 152)

## SPECIFICATION CHECK-OFF CHART

| *Subject of paragraph* | *Conditions Covered* |
|---|---|
| **Scope of Job** | Names equipment wanted and identifies it by size or application, as: "one (1) 20,000-kw turbine-generator" or "three (3) boiler feed pumps." |
| **Patents** | Places patent responsibility entirely on the contractor and requires him to save the purchaser harmless in the event of infringement suits or injunctions. |
| **Risks, Permits, Ordinances and Laws** | Makes the contractor responsible for obtaining all permits, obeying all laws and ordinances, and for assuming all property damage and personal liability risks in connection with the work he is undertaking. |
| **Signature of Contract** | Included in special cases to make certain that the contractor cannot disclaim liability on the basis of unauthorized signatures. |
| **Equipment Particulars** | Provides bidders with complete detailed information, of what is wanted. Should indicate where contractor's work begins and ends. This section is backbone of the specification. |
| **Location** | Provides information to bidders on exact site of work, street address, floor level, facilities for delivery to the site. |
| **Guarantees** | Sets forth in precise form, the guarantee of performance that the bidder must make, as a minimum. |
| **Price and Time** | Starting and completion dates are given in these paragraphs, together with the nature and value of penalties and bonuses, if any. Bidders are given here, directions for submitting prices and their bases, alternate proposals, if any, are invited. |
| **Information and Drawings** | Bidders are informed of data, drawings, pictures and other information they are expected to furnish with their bids. This information is to be used in comparing bids and is of importance in reaching a decision. |

# Plant Data Book Shows the Way To Improve Operation

**Here's one Chief's plan for better understanding: In a convenient spot in your plant collect specified test and calculated performance figures of major equipment. Then indicate methods for your operating crew to judge, compare daily performance**

▶ POWER-PLANT OPERATION is in itself a definite business function. So why not take a page out of business' book, and apply it to the power plant? Forstmann Woolen Co's chief engineer, Frank L Bradley, did just that in the company's Passaic, N. J., plant.

Under one cover are collected all performance figures—specified, test or calculated—for major pieces of equipment in the powerhouse. The book's nine sections range from a general plant description to specifics, such as heat balance. In addition to this manual, methods for determining individual or combined performances were set up as a guide to plant operation.

### THE BOOK'S DIVISIONS

Each section has a descriptive commentary, calculation sheets and performance curves of the equipment covered. In general, specified performances form the basis for calculations. For equipment like pumps such figures serve merely as references so, where available, test data have been used.

This material constitutes the source for specified performance with which actual conditions may be compared. It is necessary, of course, to make due allowance in actual operation for variations from the nominal or specified.

In a general opening section, there appears a basic flow diagram, Fig. 1, for normal plant operation. This diagram excludes minor apparatus, such as steam jets, reducing valves, turbine auxiliary oil pumps.

**Extracted Steam.** A description of the general plant operating scheme accompanies this over-all diagram. Much of it gives operating details, but some explains the why of operation. For instance, "Since for mill purposes extracted steam is as good as steam from a reducing valve, power generated by extracted steam in going from the (turbine) throttle to the extraction stage is obtained at very little direct cost. The heat content of the steam to be extracted drops from 1261 Btu per pound at the throttle to between 1165 and 1200 Btu per pound at the extraction stage, a heat drop representing less than one hundredth of a pound of coal per kwhr generated from this steam. Of course, other charges, plus the steam that goes to the condenser, make the cost of total power more than this."

**Electrical Vs Steam Drive.** Again, another example: "The auxiliaries are driven by small mechanical drive turbines as far as feasible, and all exhaust at the same pressure as the extraction

**Right: A set of curves compares two boiler loading methods: dividing the load equally or taking base load on one and swings on the other boiler**

**General plant layout below shows all major equipment, principal load - distribution points for headers giving steam**

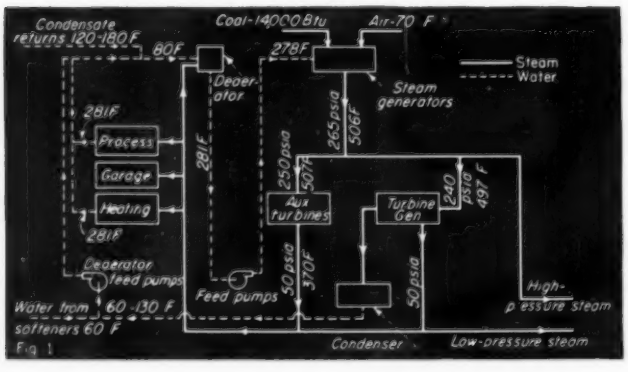


Fig. 1

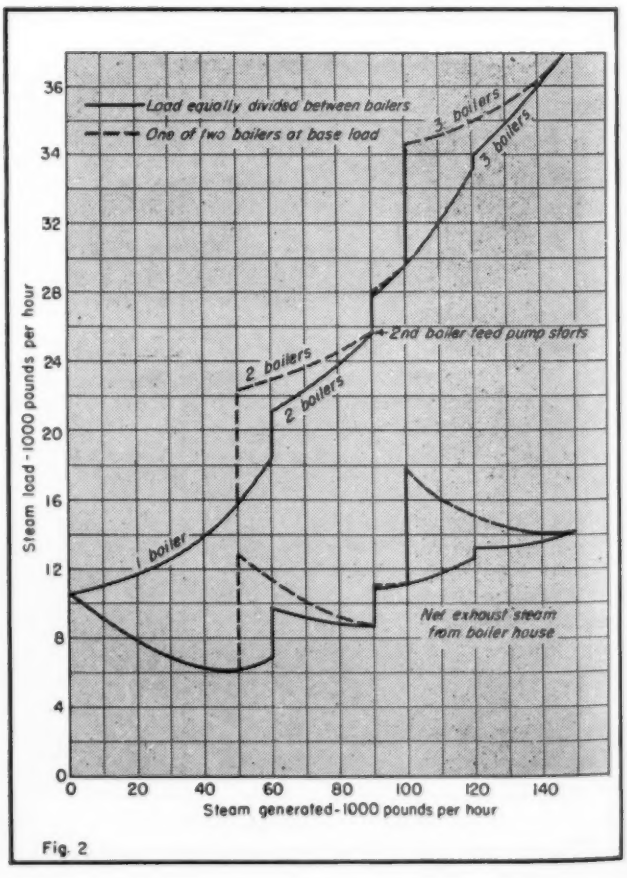
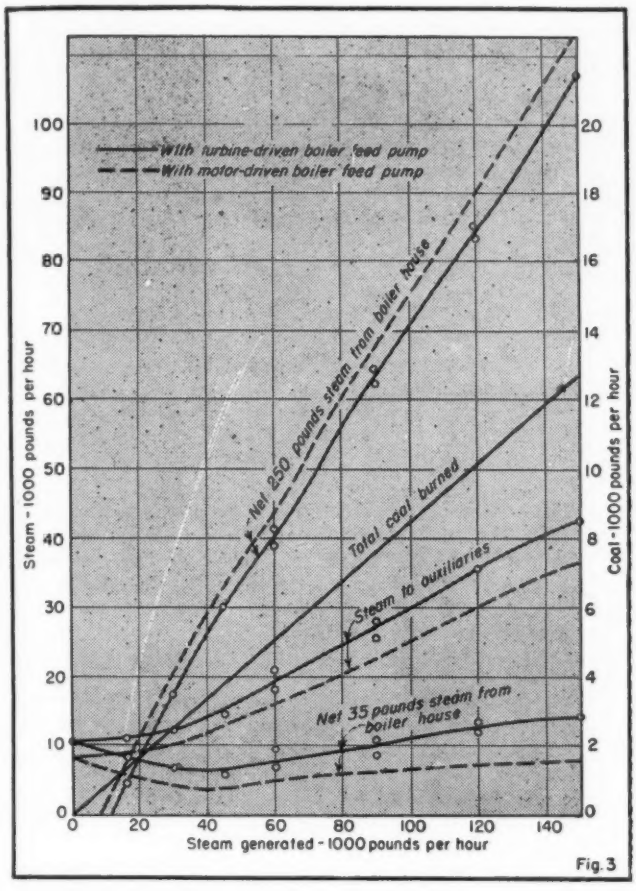


Fig. 2


With turbine-driven boiler feed pump
With motor-driven boiler feed pump
Net 250 pounds steam from boiler house
Total coal burned
Steam to auxiliaries
Net 35 pounds steam from boiler house
Steam - 1000 pounds per hour
Coal - 1000 pounds per hour
Steam generated - 1000 pounds per hour
Fig. 3

**All the condensate flow handled by the one condenser during extraction operation follows the curve at right**

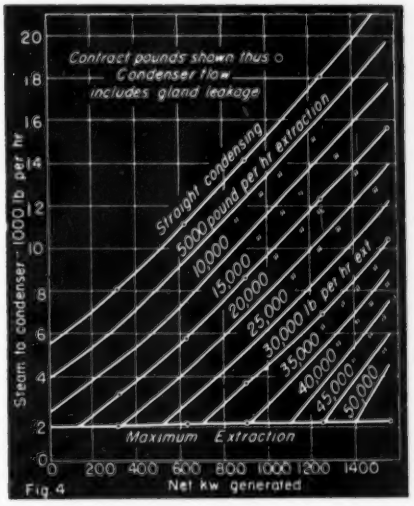


Fig. 4

**Curve, left, gives helpful operating comparisons of the coal consumption, and the distribution plan of steam load for different totals of steam generation**

steam. In this way mechanical energy for driving the equipment is obtained with practically no loss in the quantity of steam and with only a small amount of heat taken away."

## HOW TO JUDGE PERFORMANCE

The boiler-plant section shows how to make available data a working aid. An example develops in making performance data given in a contract apply to actual operating conditions. In the Passaic plant an exhaust system of 35 psi ties into the feedwater cycle. Contract data, however, were set up on feedwater of 220 F so boiler performance figures had to be adjusted to actual feedwater temperature of 278 F.

In keeping with the tone of this guide to operating judgment is this explanation. "This increase of temperature (from 220 F contract to 278 F actual) means feedwater is heated to a higher temperature by steam, and consequently the furnace is operated at a lower rating for the same amount of steam.

**Feedwater Heating.** Opportunity for another basic plant operating lesson comes in discussing feedwater heating. "It must not be assumed because feedwater is supplied to the boilers at 278 F instead of 80 F (the temperature of water entering the deaerator from condensate returns and softeners) that there is a corresponding saving in coal amounting to 278-80 or 198 Btu per pound of steam. The boiler plant as a whole still has to heat water from 80 F whether it is done by steam or directly by the furnace. Feedwater heating simply means for each net pound of steam delivered by the boiler plant, the boiler must generate an additional amount of steam to take care of the feedwater heating, and the heat supplied by the coal is just the same. However, feedwater heating (1) improves the operation of the boiler and reduces trouble due to feeding of cold water (2) makes it possible to develop power with turbine drives for the auxiliaries while still retaining the full heat value of the exhaust from these turbines."

Before listing steam requirements of the deaerator this book of operating whys develops the formula applied to calculating these needs under various steam and inlet-water conditions. A full description of each factor in the formula makes the formula a working tool.

**Boilerhouse Performance.** Curve sheets, Fig. 2 and 3, permit operating comparisons. Fig. 2 compares operation of boilers with plant load equally divided between operating units with operation of one or two boilers with base load at 50,000 lb per hr and taking load swings on the remaining boiler. The other curve, Fig. 3, shows the coal burned and the steam distribution for the entire boiler plant plotted against the steam generated. A smooth curve connects the various known points to obtain an average performance, allowing for overloads or overlaps in starting up additional units.

Both curves carry performance to zero steam generation, an impossible situation with all auxiliaries running. But this device shows the theoretical minimum load at which one of the boilers could run.

**Turbine-Generators.** Data for per-

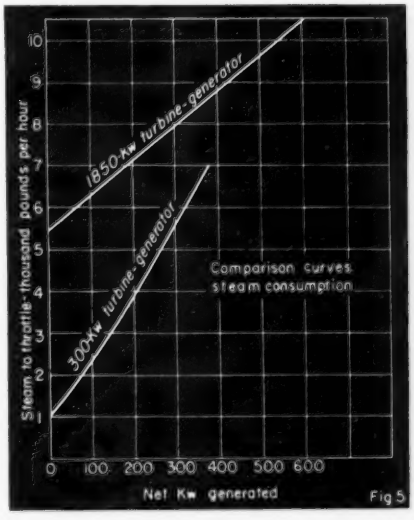


Fig. 5

**Steam consumption, compared between turbines, gives advantage to small one but ignores starting cost**

formance curves of the turbine-generators come from contract figures. The curves include some interpolation points to give intermediate conditions. Forming the subject matter of these curves is basic information like pounds of steam per kwhr. pounds of steam per hr for various rates of net kw generated as well as condenser flow per kwhr, Fig. 4, at various extraction rates. Another curve, Fig. 5, compares steam consumption of two turbines, a 1250-kw and a 300-kw unit, under straight condensing operation. This comparison indicates an advantage for the smaller machine, but one often taken-for-granted factor influences the selection. That factor is a realization of the cost in steam (about 5000 lb) for starting and warming up to change from one unit to another, and back again. This book, or one like it for your own plant, drives that cost factor home to the operating man.

**Condensers.** Contract figures again form the basis for curves in this section. One curve, particularly helpful in scheduling condenser cleaning, is Fig. 6. On this simple sheet appear the necessary performance figures that permit a ready check on fouling of condenser surface. Test readings that fall way off these contract figures indicate a need for condenser cleaning. General condenser arrangement shows in Fig. 7.

**Pumps.** All data for plotting performance curves for the pumps come from actual tests. In addition, two curves appear for convenience in converting gpm to lb per hr, and from psi to feet of water at various temperatures.

**Over-all Performance.** This section draws a dividing line between operation under two broad conditions: (1) turbine driven auxiliaries (2) motor-driven auxiliaries. In the first, the auxiliary exhaust is increased; in the second the power generated is increased.

From this starting point, five items—electric demand of the plant, the 250-psi steam demand and the 35-psi demand of the plant as well as the 35-psi demand for process water and garage heating—are made chargeable to the mill as net output of the powerhouse. Of these items this plant meets the electric power and the 250-psi and 35-psi steam demands. Process-water heating and garage heating come from takeoffs ahead of the meter. The process-water heating load, however, has a family of curves defining its steam requirements. Garage heating can only be estimated.

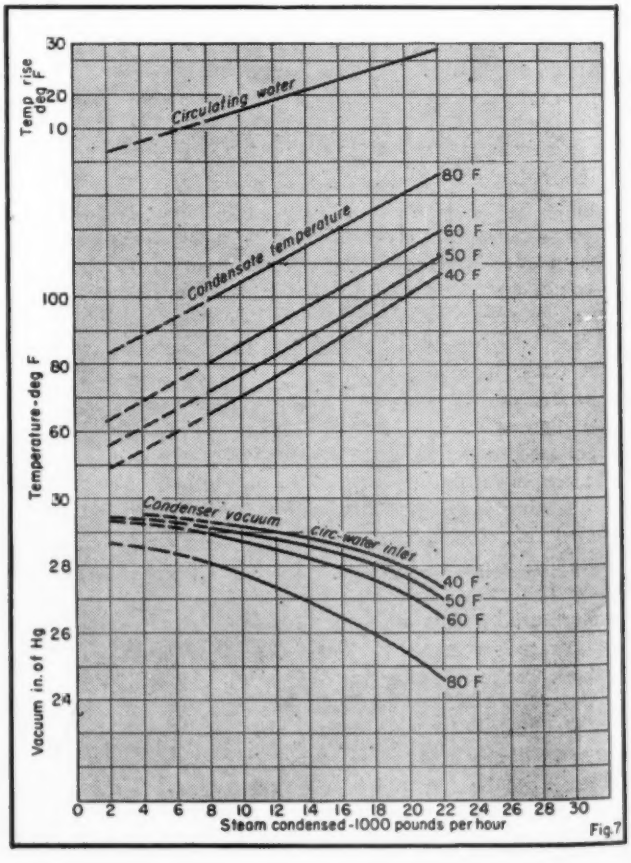
Steam used for feedwater heating by the deaerator is directly dependent upon rate of steam generation, and this applies also to auxiliary-drive turbines. Curves not shown here are provided for these demands.

With this background of various independent variables the point is made that any given load is a combination of demands. To calculate performance of the components in the powerhouse, then, requires cut-and-try methods. First an assumed rate of steam generation is made, and from this the various uses and sources of steam are tabulated. This gives a revised rate. This rate again goes through the cut-and-try process until a value close to the actual develops.

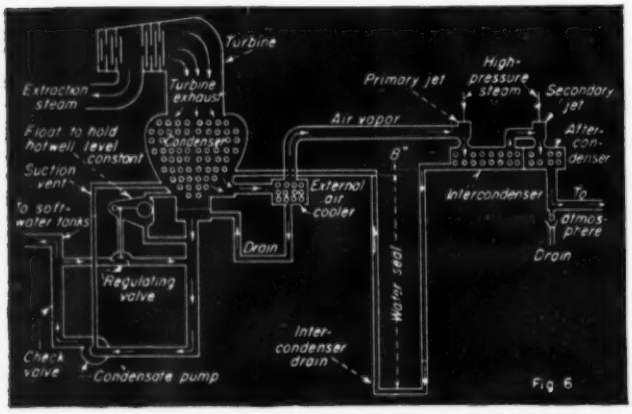
**Boiler Test.** This section devoted to the important operating guide of boiler efficiency outlines the means of conducting such a test with the instruments and equipment in this plant. It furnishes a set of calculations based on the *ASME Code* that serves as a guide for calculating boiler performance from routine operating readings. Some adjustments and adaptations appear in the interests of a more suitable method for the particular plant setup.

All in all, this fairly comprehensive treatment of the power-plant elements serves to (1) advance understanding (2) answer questions (3) explain the whys (4) develop reasoning and insight.

**Performance figures based on the contract for condensers, right, permits making a ready check on fouled surface. Any wide difference between test readings and contract ones indicates need for scheduling a condenser cleaning**




**Schematic diagram of condenser equipment helps the operator visualize working order and function of different auxiliaries and their relation to this major equipment**



John Herzog casts a loving eye on one of the many pieces of equipment he selected for the new brewery and power plant being constructed under his engineering direction

# Varied Experience Key to Success for

# JOHN HERZOG

**Now deeply interested in building a new generation of power engineers, he'd like to see an apprentice system that would provide the broad training that he got by his own initiative**

▶ THESE DAYS John Herzog is a busy and happy man: As chief engineer at San Francisco Brewing Corp he has the opportunity of building his own ideas into a new brewery and power plant. Although he had no previous brewery experience and never expected to work in one, much less to build one, he prepared for this job all his life by consciously seeking experience in all phases of power engineering and construction. Because his knowledge of the basic principles of power and process engineering were driven home by seeing them applied in many fields, he is able to apply them to still another field. Consequently the plant he is building reflects his fresh viewpoint in its many innovations.

At the age of 18, fresh from technical school in his native Hesse-Kassel, young John Herzog embarked on the business of gathering experience. In the oil fields of the Southwest, where he made his start, he worked as roustabout, fireman and engineer. At the same time, he plugged away at correspondence courses in steam and mechanical engineering. When World War I interrupted John's oilfield experience he went to sea as a submariner—trial engineer on new pigboats.

With the war behind him, John sought building experience, and in the next few years got it aplenty, working as plumber, steam fitter and electrician. Taking part in the construction of San Mateo County Hospital, in 1920, was his first connection with the institutional field, which was to be his for the next 20 years.

Switching from construction to operation, but staying with the hospitals, John became chief at St. Mary's in San Francisco, a post he held for many years. He later became supervising engineer for the seven hospitals and military schools operated by the Sisters of Mercy, while retaining direct control at St. Mary's.

The second World War called John back to ships again—this time building them at the Basalt Rock Shipyard, Napa, Calif. Here, many miles from the sea, were built salvage vessels and mine layers. John served as electrical superintendent of the yard and engineer in charge of tests and trials. A high spot in this wartime period was the day that Mrs Herzog christened a ship John had helped to build.

With a solid background of both operating and construction experience, John was just the man San Francisco Brewing Corp was looking for at the war's end. Today he operates an existing boiler plant and supervises brewery maintenance, all with one hand, while with the other he builds a new brewery and power facilities, and plans for the day when he will cut in the new without interrupting production.

Working directly with the general manager, and consulting on process matters with the brewmaster, John has virtually a free hand in the engineering of the new plant. Into it are going ideas gleaned from an extensive survey of modern breweries, and checked against his hard-gained knowledge of what will and won't work in practice.

Some of the ideas John is betting on include purified air instead of atmospheric for beer cooling, ice-water cooling instead of direct-expansion or brine cooling, a dry system for recarbonization, and use of unit coolers instead of pipe coils in the lagering and storage rooms.

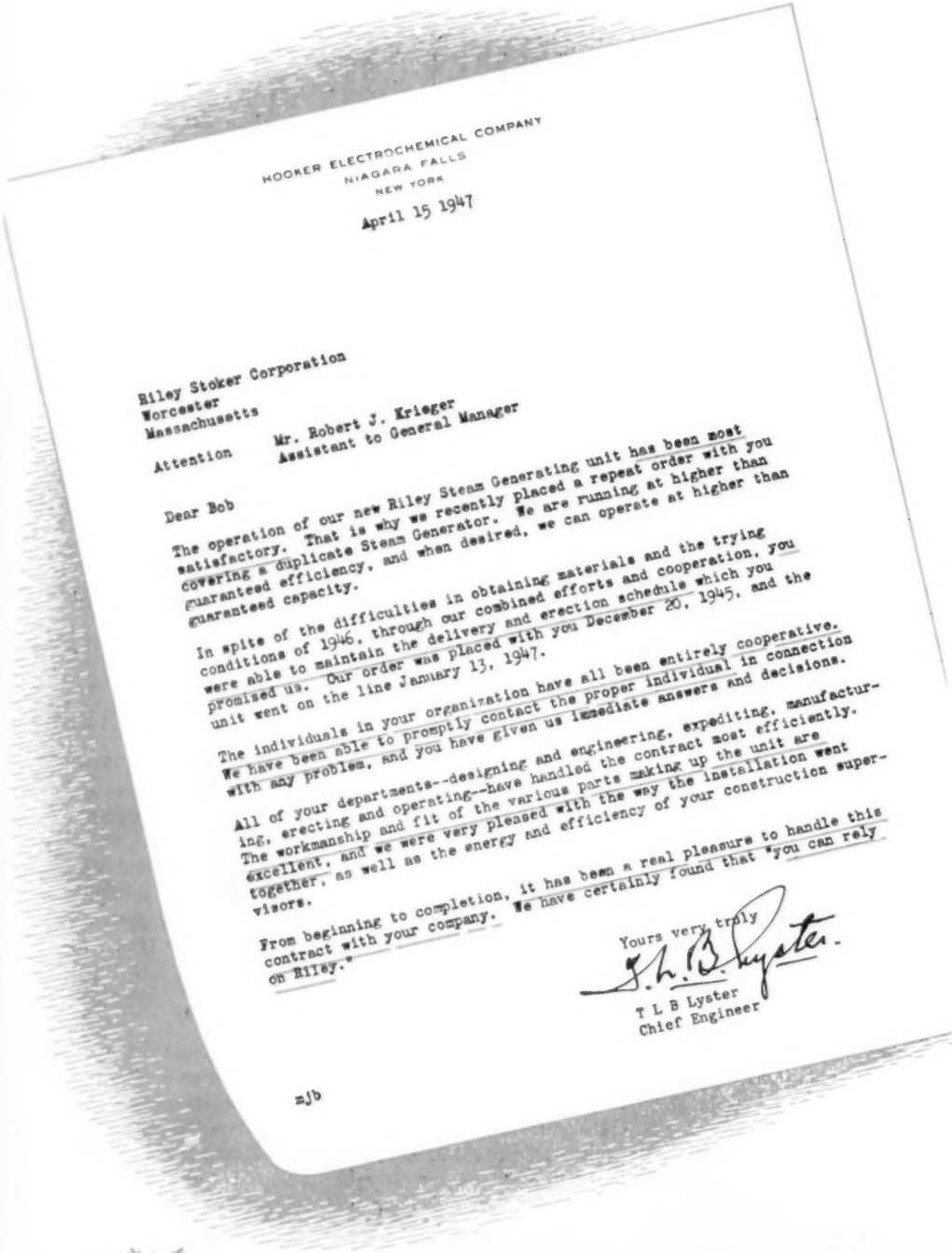
### EQUIPMENT FOR A MODERNIZED PLANT

Power services for the new brewery will come from a completely modernized plant. Included are three 4000-sq-ft Stirling-type boilers for gas firing with oil as standby, with deaerating heaters and other usual auxiliaries. Electricity, available at low rates, is purchased. Refrigeration will total about 500 tons, in several units. Evaporative condensers on the ground floor will replace the usual roof cooling units, because Herzog believes that easy access helps to guarantee better control and maintenance. For bottling machinery and blowing out tanks, compressed air will be supplied by reciprocating units with carbon rings.

Busy as he is operating one plant and building another, John finds time for active participation in engineering societies, a practice in which he is a firm believer. A member of ASME and NAPRE, he has held all chairs in San Francisco No. 1 of NAPE and acted as special deputy.

He has written articles for the technical magazines, many of them dealing with the problem of apprentice training, a special interest. Regretting deeply the lack of all-round engineers today, John believes in securing experience in a variety of plants and fields, and advocates an apprentice system that will provide this kind of training.

# We believe, you will enjo



HOOKER ELECTROCHEMICAL COMPANY
NIAGARA FALLS
NEW YORK

April 15 1947

Riley Stoker Corporation
Worcester
Massachusetts

Attention Mr. Robert J. Krieger
Assistant to General Manager

Dear Bob

The operation of our new Riley Steam Generating unit has been most satisfactory. That is why we recently placed a repeat order with you covering a duplicate Steam Generator. We are running at higher than guaranteed efficiency, and when desired, we can operate at higher than guaranteed capacity.

In spite of the difficulties in obtaining materials and the trying conditions of 1946, through our combined efforts and cooperation, you were able to maintain the delivery and erection schedule which you promised us. Our order was placed with you December 20, 1945, and the unit went on the line January 13, 1947.

The individuals in your organization have all been entirely cooperative. We have been able to promptly contact the proper individual in connection with any problem, and you have given us immediate answers and decisions.

All of your departments--designing and engineering, expediting, manufacturing, erecting and operating--have handled the contract most efficiently. The workmanship and fit of the various parts making up the unit are excellent, and we were very pleased with the way the installation went together, as well as the energy and efficiency of your construction supervisors.

From beginning to completion, it has been a real pleasure to handle this contract with your company. We have certainly found that "you can rely on Riley."

Yours very truly

T L B Lyster
Chief Engineer

mjb

List of Recent
Riley Repeat Orders

Hooker Electrochemical Co.
Monsanto Chemical Co.
Carbide & Carbon Chemicals Corp.
Swift & Co.
American Cyanamid Co.
Houston Lighting & Power Co.
Celanese Corp. of America
Iowa Illinois Gas & Electric Co.
Great Lakes Steel Corp.
Union Electric Co. of Missouri
Interstate Power Co.
Standard Oil Co. of California
Norton Company
Gulf Power Co.
Pennsylvania Salt Co.
Walford Paper Products Co.
Container Corp. of America
Nicholson File Co.
Gaylord Container Corp.
Upper Michigan Power & Light Co.
Northern Paper Mills
Allis Chalmers Mfg. Co.
Central Ohio Light & Power Co.
Beechnut Packing Co.
Modine Mfg. Co.
Bemis Bros. Bag Co.
Dow Chemical Co.
Central Illinois Light Co.
Otter Tail Power Co.
Mississippi Power Co.
Scovill Mfg. Co.

TRADE MARK Rx REGISTERED

# RILEY

## STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Cleveland Detroit Chicago St. Louis Cincinnati St. Paul
Pittsburgh Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis

COMPLETE STEAM GENER

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

# doing business with Riley

We feel we can sincerely state that you will enjoy doing business with Riley—at least our users tell us they have. (Read the letter from Hooker Electrochemical Company, a major manufacturer of Chlorine, Caustic Soda and over 100 related products.) All of us here at Riley will do our best to make it so.

When you purchase from Riley you will not only get equipment which will give entirely satisfactory operation at high efficiency, but you will also find that you are working with a conscientious co-operative organization which is just as anxious as you to make your particular installation an outstanding one.

### "THE OPERATION HAS BEEN MOST SATISFACTORY"

That is the customary statement from users of Riley Steam Generating Equipment. Almost invariably Riley units operate at higher efficiencies and capacities than guaranteed. We realize it pays to give the customer a little more than his money's worth.

### "YOU WERE ABLE TO MAINTAIN THE DELIVERY AND ERECTION SCHEDULE"

Riley delivery promises are made in good faith and are considered a definite obligation to be met. In spite of the difficulties in this regard during the past few years, Riley has reason to be proud of their performance in meeting delivery promises.

### "THE INDIVIDUALS HAVE BEEN ENTIRELY CO-OPERATIVE"

We believe you will find the individuals of the Riley organization entirely competent and not at all arbitrary—ready to co-operate with you in every possible way.

### "WE HAVE BEEN ABLE TO PROMPTLY CONTACT THE PROPER INDIVIDUAL"

There is no red tape in the Riley organization. You can immediately and directly contact the proper individual and get a prompt answer and decision to your question.

### "THE WORKMANSHIP WAS EXCELLENT"

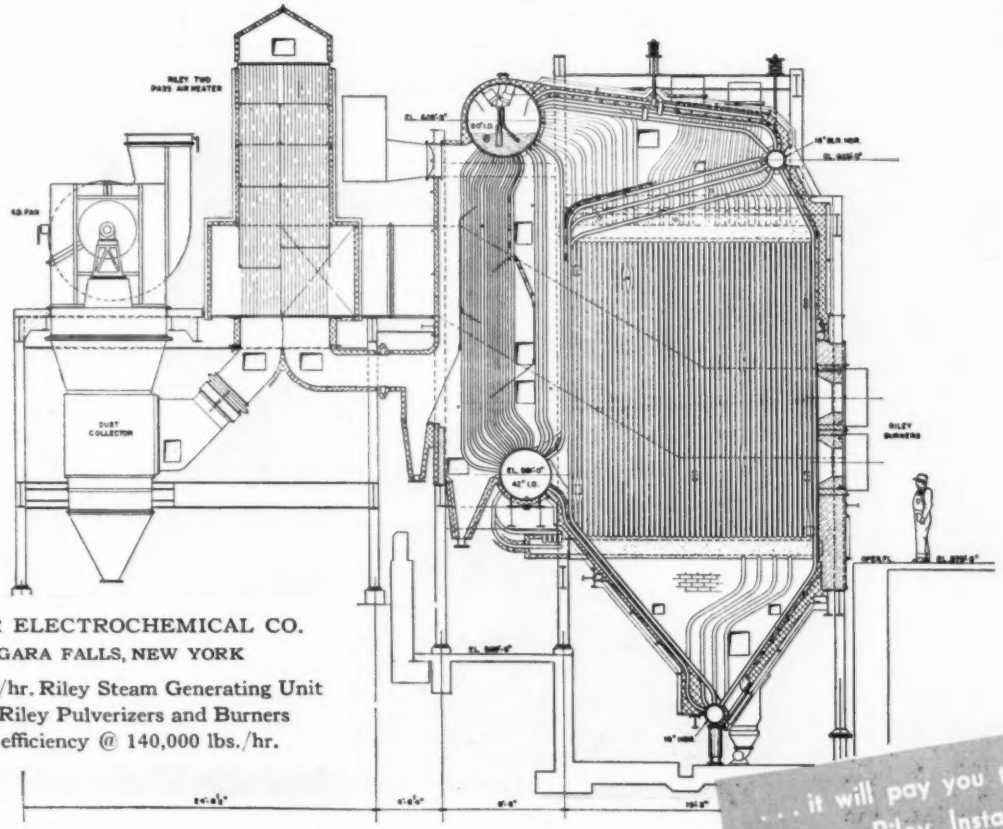
High quality of workmanship is necessary for long trouble-free life. A visit to Riley's fabricating plants or to any job under erection will assure you of the excellent work performed by Riley's shops.

### "IT HAS BEEN A REAL PLEASURE TO HANDLE THIS CONTRACT WITH YOUR COMPANY"

It is not surprising that so many Riley users say, "you will enjoy doing business with Riley," because everyone at the Riley Stoker Corporation is determined to make it so.

### "WE HAVE FOUND THAT 'YOU CAN RELY ON RILEY'"

Riley could not have climbed so rapidly to their position of a leader in the boiler industry if users had not found they could rely on Riley and Riley equipment.



HOOKER ELECTROCHEMICAL CO.
NIAGARA FALLS, NEW YORK

168,000 lbs./hr. Riley Steam Generating Unit
fired by Riley Pulverizers and Burners
86.5% efficiency @ 140,000 lbs./hr.

*A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs*

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

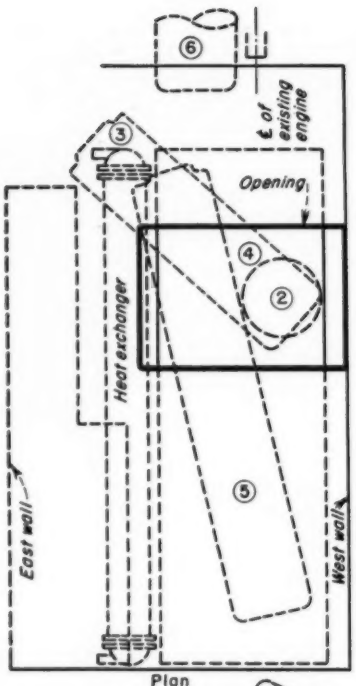
ATING UNITS •

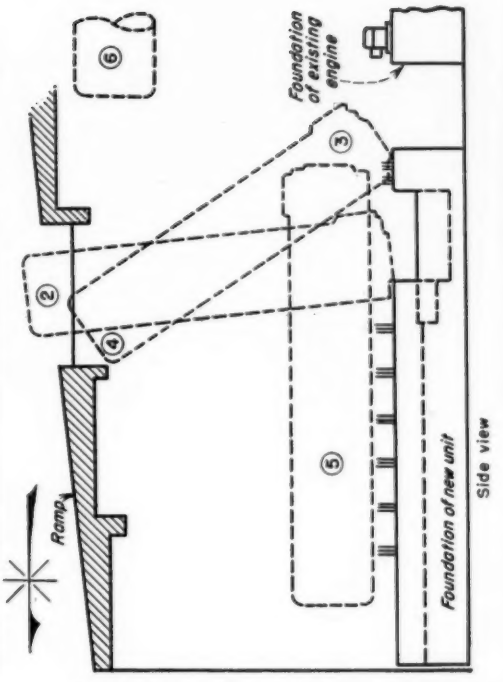
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

# DIESEL
# Down a Hole

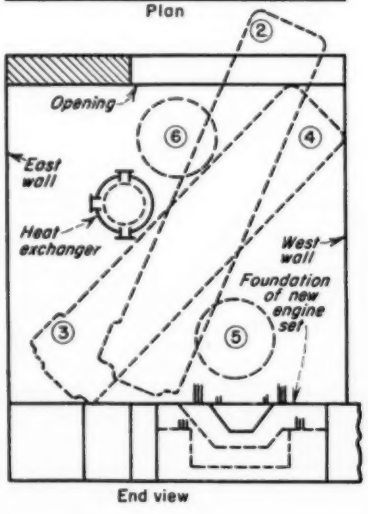
**Careful planning and skillful rigging put a 500-kw diesel through a 6x10-ft access hole at No. 2 Park Avenue. Here's how it was done, step by step**

▶ THE ORIGINAL PLANT at No. 2 Park Ave, N. Y., was installed in what had been a coal pocket for boilers, actually installed to burn oil. This space was largely under a ramp from the street down to a loading platform. When a new unit was to be put in, the only practical access was obtained by cutting a hole in half the ramp, leaving half in service. Here's how E J Kates, the consulting engineer, worked it out.



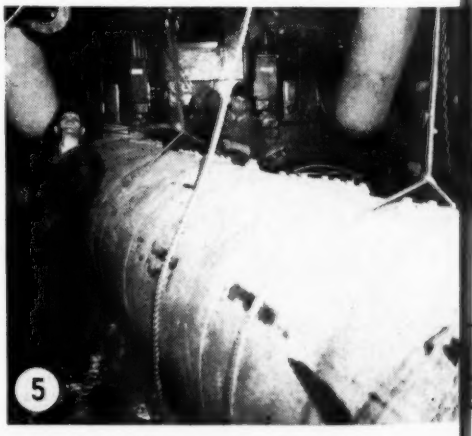




**1** Within limits of girder spacing, largest hole that could be cut actually worked out to be 6 ft, 6 in. by a little over 10 ft, but a heat exchanger (see plan) further limited maneuvering space to 9 ft, 6 in. First step was to install a silencer weighing 4000 lb, and 3 ft, 6 in. diameter by 21 ft, 3 in. long. Following a sequence worked out with templates, it was handled as shown in photos 2 to 6

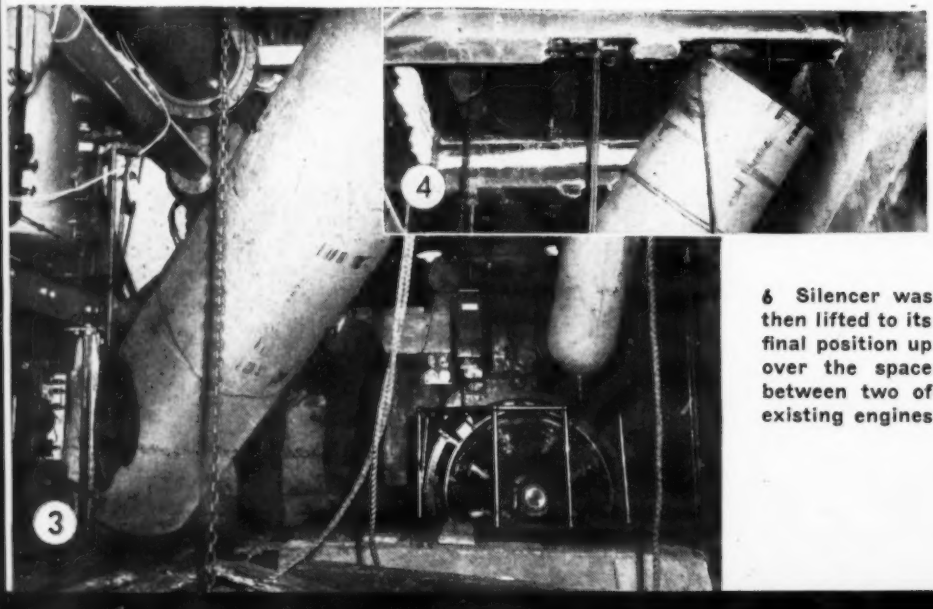


**2** Slung from a heavy scaffold over the opening, the silencer was lowered and canted toward the east and south

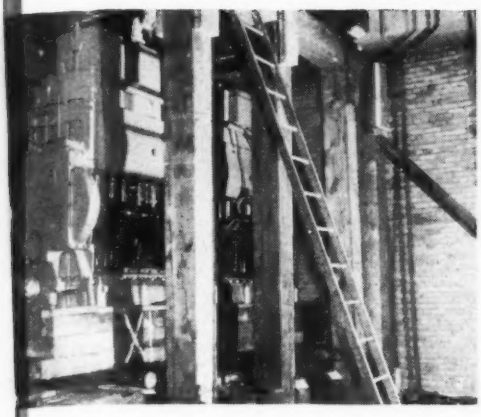
**3, 4** With the lower end under the heat exchanger and as far as it could go, the top end just cleared the wall



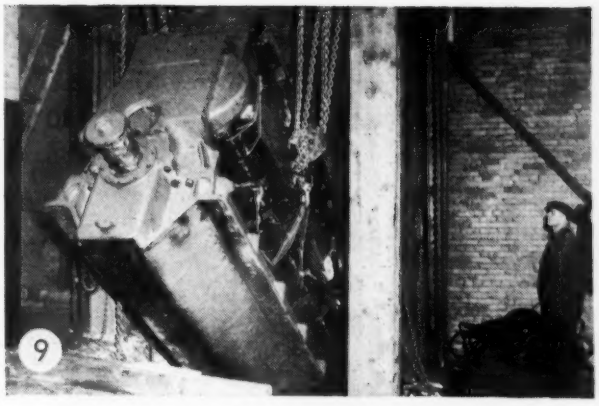
**5** As the silencer was lowered to a horizontal position it was swung toward center of the new-unit space



**6** Silencer was then lifted to its final position up over the space between two of existing engines

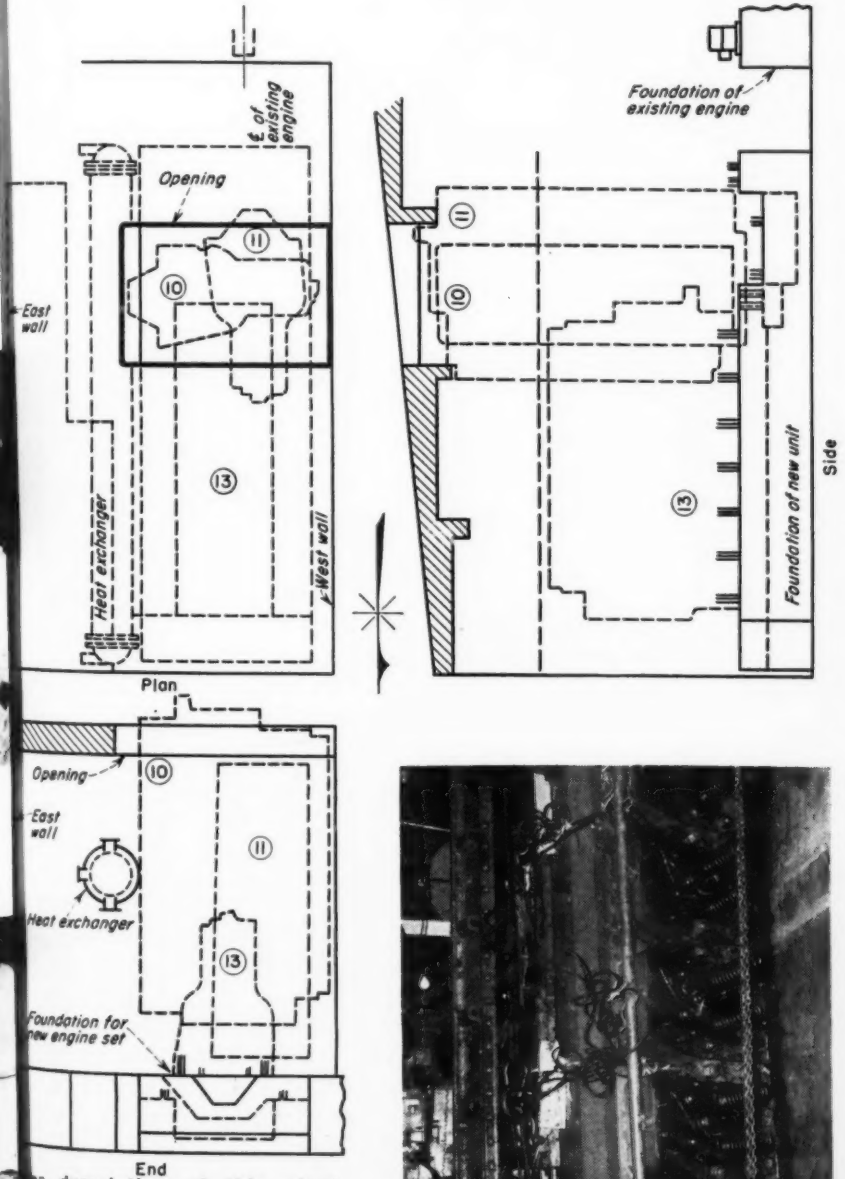


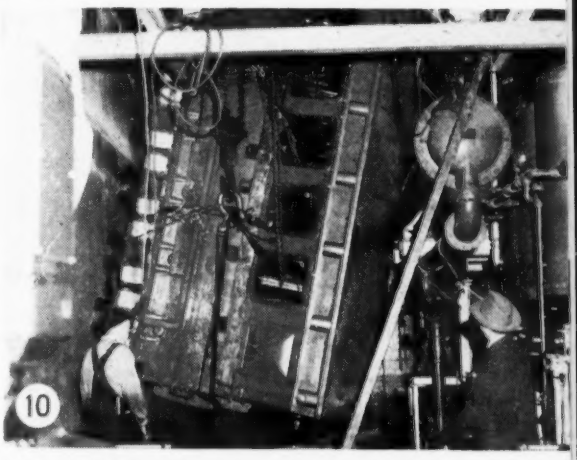
**8** The engine rests on cribbing over the opening while rigger removes valve covers



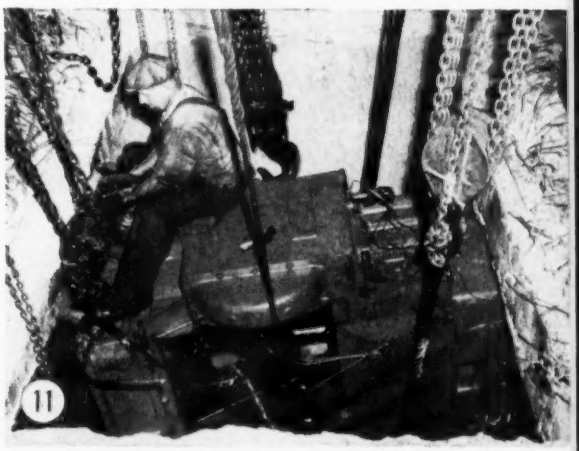

**9** Stripped down to the valve stems, the engine is suspended from the scaffolding and is gently tipped to begin its descent through the opening

**7** The engine proved even tougher because of its weight (53,000 lb) and size (8 ft, 6 in. high with the valve gear removed). As shown in photos and the correspondingly numbered positions on the diagram, it was lowered end down, then, still hanging end down, but clear of the hole, was rotated 90 deg, and finally swung to a horizontal position on the foundation

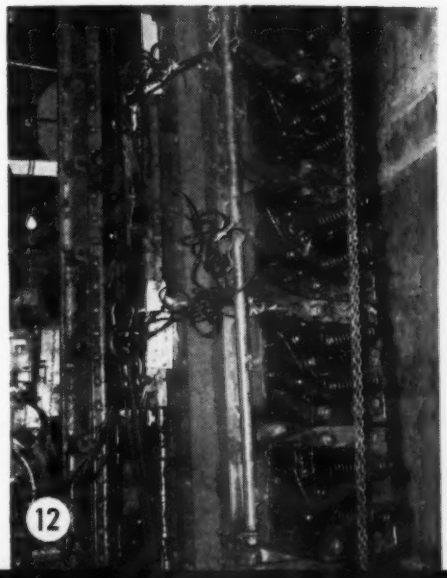


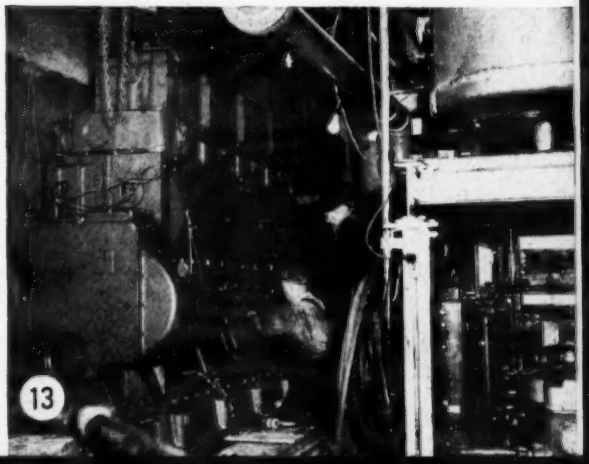




**10, 11** After being lowered through the hole, photo 10, the engine was rotated 90 deg, as shown from above in photo 11



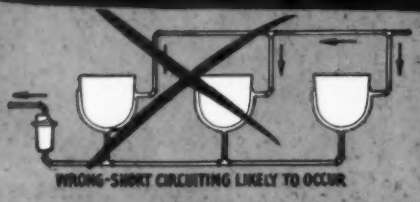

**12, 13** Rotating the engine brought it above position it would finally occupy, but hanging on end, photo 12. Lowering one end, raising the other, did the rest

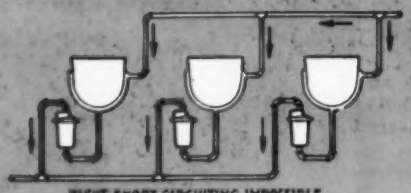


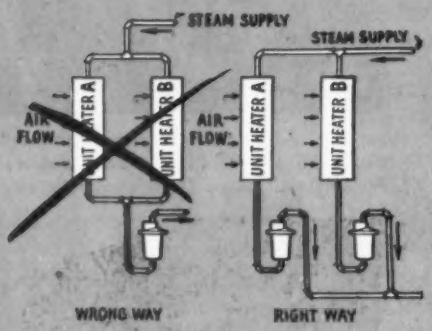

or description of this plant
e pages 83-85.

# WHY "UNIT TRAPPING"



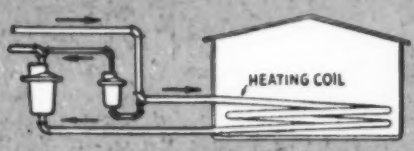




**A cold kettle will condense more steam and have lower outlet pressure than a hot kettle. The result is back-flow into the cold kettle — pocketing air and condensate.**




**Outlet pressure for Heater B will be higher than for Heater A until enough air accumulates inside A to reduce its condensation rate to a par with B.**

WRONG-COIL IN TANK WILL BE SHORT CIRCUITED




RIGHT-COIL DRAINED INDEPENDENTLY OF SUPPLY LINE

**Never try to drain the steam header with the same trap that is supposed to drain the unit being supplied with steam. Condensate and air will be pocketed in the heating unit.**

SEE OUR CATALOG IN SWEET'S

## WHAT UNIT TRAPPING IS:

By "Unit Trapping" is meant the use of an individual trap for draining each steam consuming unit, including separate chambers, chests or cylinders of a single machine.

## WHY IT WORKS BETTER:

When more than one unit is drained by a single trap, air and condensate from one or more of the units may fail to reach the trap. This is due to the fact that any difference in condensing rates will cause a difference in pressure drop. This may permit back-flow of steam into the unit with the higher condensing rate, thereby impeding the flow of air and condensate to the trap. No drainage will take place from the unit condensing the most steam until the static head of condensate in the drain line offsets the difference in pressure. Such a situation leads to inefficient and unbalanced heating. However, the use of a separate trap on each unit permits individual operation without regard to any differences in condensing rates or pressure drops. Each unit gets the full benefit of dry steam without any blocking of condensate or air.

## WHY ARMSTRONG TRAPS GET SUCH GOOD RESULTS:

They not only handle condensate as fast as it accumulates, but they draw off air in the system as well. This is essential to fast heating and uniform high temperatures. You don't have to be afraid of increasing the number of traps in your plant because Armstrongs seldom need attention. They won't clog or stick; dirt is swirled right through; the chrome steel valve and seat and corrosion-resistant stainless interior stand up in constant service for years and years.

**SEND FOR THE ARMSTRONG STEAM TRAP BOOK . . .**

36 pages of data on trapping practice, selection, installation, capacities, etc.

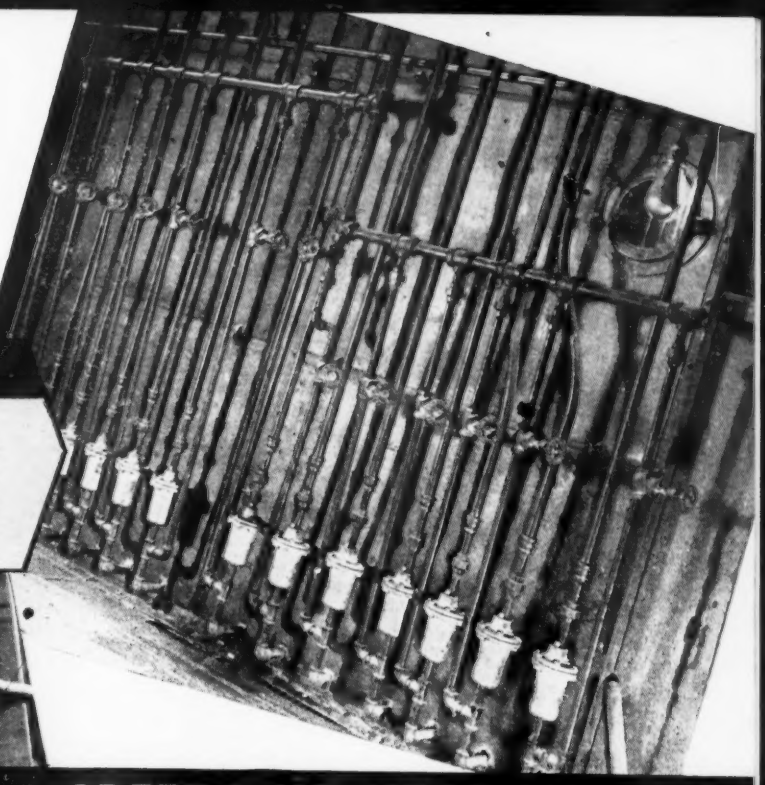
**ARMSTRONG MACHINE WORKS**
**812 Maple St., Three Rivers, Michigan**

ARMSTRONG INVERTED BUCKET STEAM TRAP

# ARMSTRONG *Inverted Bucket* STEAM TRAPS

*Over a Million in use for* **POWER. PROCESS. HEATING**

# PAYS:

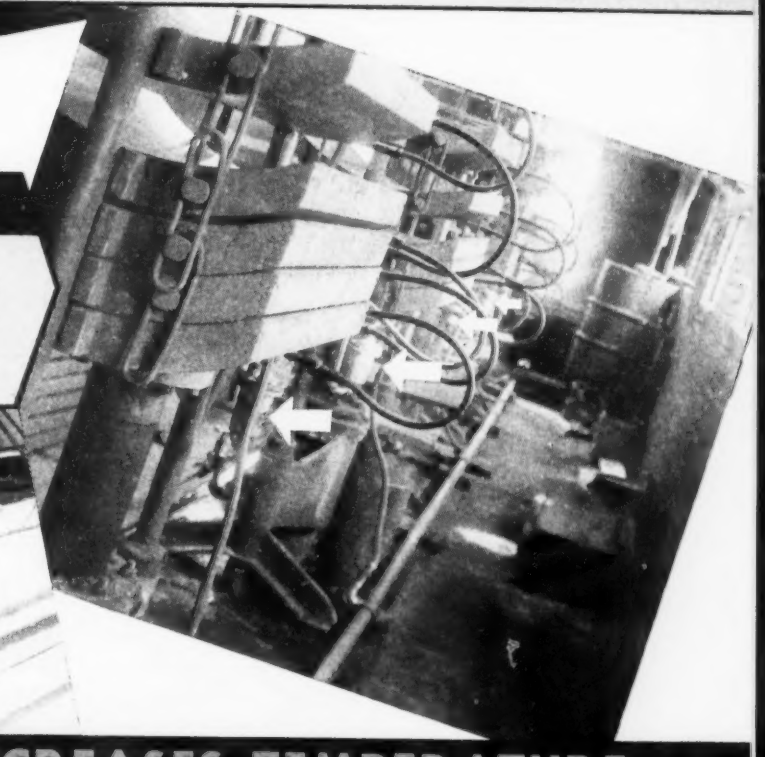


## SAVES COAL

0 lbs. of coal are saved every day by 50 Armstrong traps a plant in Ohio. They now use only two of their three ers. And maintenance has been cut 95%. (#211 traps strated are draining individual coils in a large drier.)

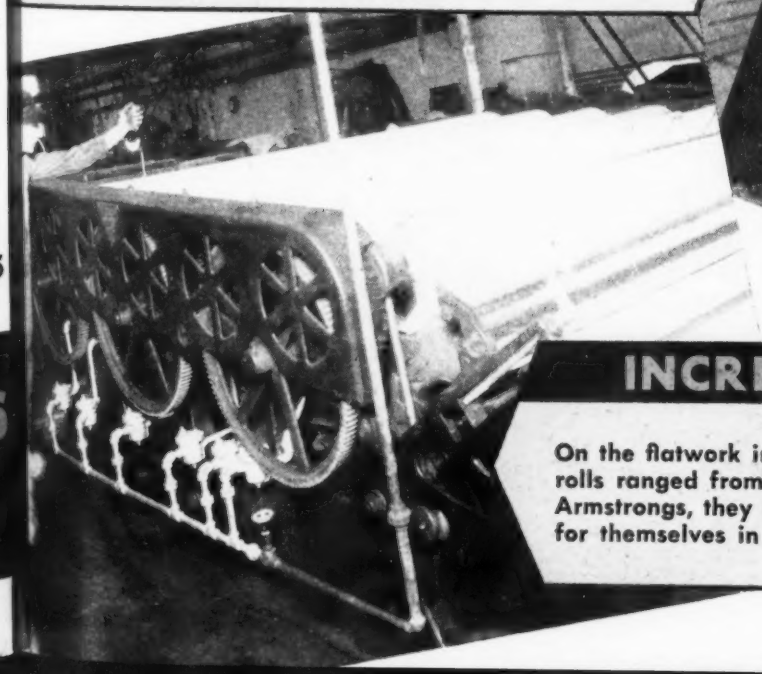
## SPEEDS UP HEATING

Before unit trapping 240 gal. cooking kettles at a Canadian canning plant, heating up time was 10 minutes. With Armstrong Unit Trapping, kettles are brought to a maximum temperature in only 7 minutes.



## INCREASES OUTPUT

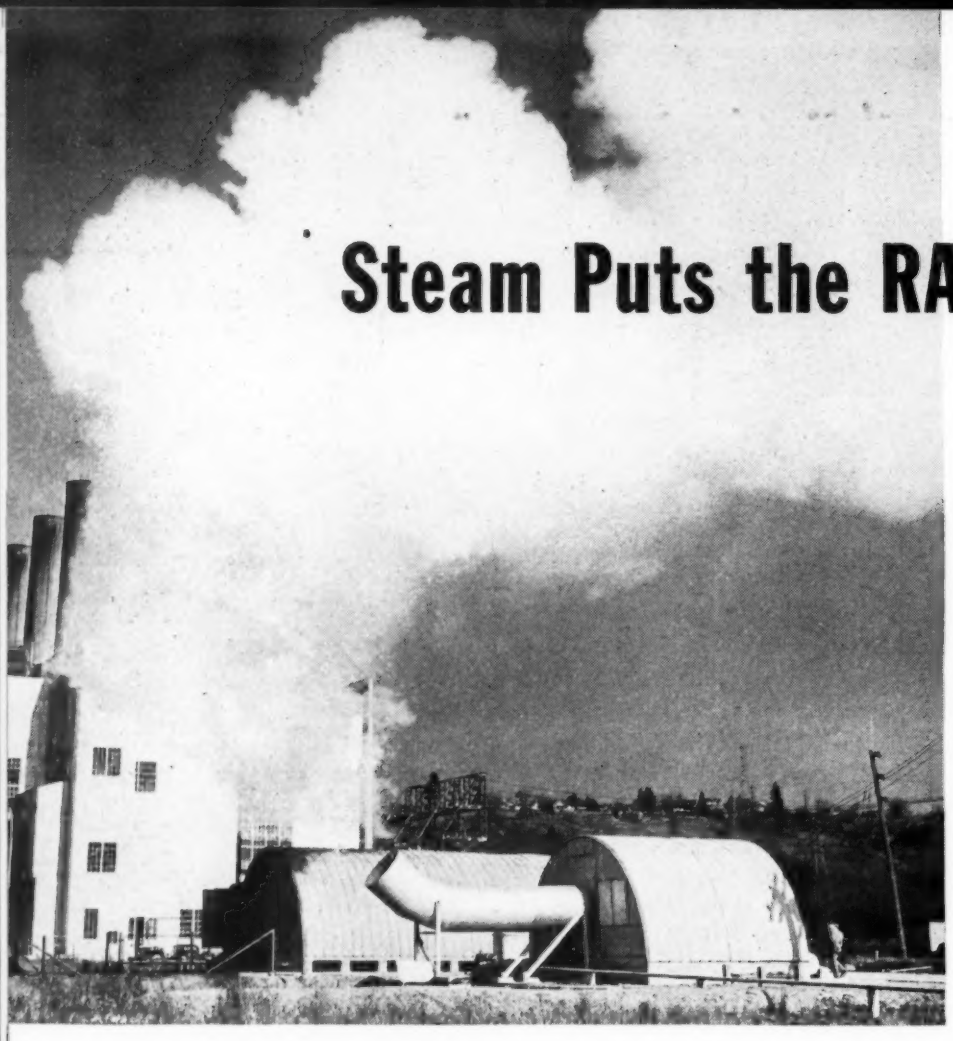
ennsylvania chair manufacturer has doubled production s wood bending presses since trapping them individually. process which formerly took 60 minutes now takes 30.

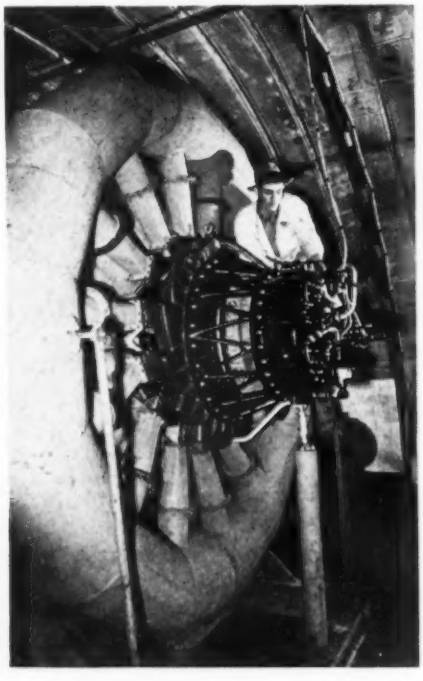


## INCREASES TEMPERATURE

On the flatwork ironer pictured, temperatures of the various rolls ranged from 220° to 275° F. Since unit trapping with Armstrongs, they range from 300° to 310° F. The traps paid for themselves in 3 days.

# Steam Puts the RAM in Ramjet





Steam from the 400-psi 750-F 80,000-kw Shuffleton power plant at left, above, is piped 300 yd to the structure at far right, which houses a GE I-40 jet engine, run "backward" to supply compressed air to the ramjet test cell at center. Just ahead of the I-40 turbine, steam is throttled to about 90 psi to maintain the normal expansion ratio

Driven by its "steam" turbine, the centrifugal compressor of the I-40 jet engine now discharges pressure air to the ramjet test cell through the manifold system shown in this photograph

Steam from Shuffleton plant (right) is carried by pipe (foreground). Turbine exhausts at far left. Air at supersonic speeds is delivered to test cell by larger pipe between two buildings

► FOR COMBUSTION TESTS of high-speed ramjet engines, Boeing Aircraft Co needed large volumes of air at supersonic speeds. The answer was found in a modification of the GE I-40 jet engine and the Shuffleton power plant of Puget Sound Power & Light, at Renton, Washington. Here's how it came about:

Boeing engineers realized that in the jet engine there lay ready to hand an efficient compressor mechanism. In normal operation, the GE I-40 consists of a centrifugal compressor and a number of combustion chambers, supplying heated pressure air to a turbine. The turbine extracts enough energy from the pressure air to drive the compressor, and the remaining energy goes out the tail as the propelling jet.

First step in modifying this unit for service as a producer of air at supersonic speeds was to provide manifolds to take the compressor discharge to the ramjet test cell instead of to the turbine, as in a normal jet engine.

The next step was to find an energy source for the turbine, now cut off from its normal pressure-air supply but still expected to drive the compressor. Steam was the obvious answer, but where to find a source able to supply up to 300,000 lb per hr for short intervals?

That's where Puget Sound Power & Light came into the picture. Their power plant at Renton, where Boeing built 1119 B-29's for the AAF, has three boilers rated at 330,000 lb per hr. Normally operated as standby, the plant could meet Boeing's discontinuous steam needs, and Puget Sound P & L offered its cooperation. The pictures show the result, with steam putting the "ram" in ramjet.

# YOUR CHANCES OF GETTING AHEAD

FOR 20 years we have been whittling away the foundations of our economic structure. We have been cutting away the incentives to "get ahead in the world," to increase production and to improve efficiency. Unless this process is reversed soon, we risk the sort of industrial stagnation that currently afflicts Great Britain so disastrously.

How far the whittling has gone is shown by the statement in the center of the page. It shows that everyone's stake in working harder and getting ahead has been reduced sharply since 1929. In that year, anyone who was even moderately successful could look forward to reaping the rewards of his success. If he earned $5,300 annually over a period of 25 years he could retire on a comfortable income of $3,000 per year. Or he could pile up enough capital to go into business for himself. He could fulfill the American dream as phrased by Abraham Lincoln in his first annual message to Congress in 1861:

"The prudent, penniless beginner in the world, labors for wages awhile, saves a surplus with which to buy tools or land for himself, then labors on his own account another while, and at length hires another new beginner to help him. This is the just and generous and prosperous system, which opens the way to all, gives hope to all, and consequent energy and progress, and improvement of condition to all."

Look at the situation today. To retire on an annual income from investment that will buy as much as $3,000 did in 1929, a young man needs to earn over $13,000 a year for 25 years. That's more than 2½ times the income he would have needed in 1929. The same thing is true of acquiring a stake in a business.

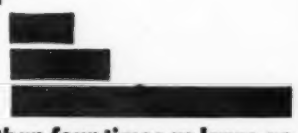
## YOUR CHANCES OF GETTING AHEAD

To see how your chances of getting on in the world have changed during the past few decades, the McGraw-Hill Department of Economics has calculated how much it now takes to save enough to acquire a retirement income or a comparable stake in a business, as compared to what it took in 1914 and 1929.

The objective set is an income from investment equal to $3,000 a year in 1929 dollars. It is assumed that the savings required to yield this income are made over a period of twenty-five years. During that period it is also assumed that $4,000 per year (in 1929 dollars) is spent on living expenses.*

*Here is how the figures work out:*

| | Yearly Income Needed |
|---|---|
| 1914 | $3,075 |
| 1929 | 5,267 |
| 1947 | 13,221 |



**It now takes more than four times as large an annual income as it did in 1914 to gain a comparable stake. It takes well over twice as much as it did in 1929.**

Changes in three factors — federal income taxes, living costs, and interest rates — explain why the income needed has multiplied so. Here's how these factors line up for the three years.

| | Federal Income Taxes Married Man, 2 dependents | | Cost of Living (Index Numbers 1935-39) | Interest Rate High-grade Corporate Bonds |
|---|---|---|---|---|
| | $5,000 income | $10,000 income | | |
| 1914 | $10 | $60 | 71.8 | 5% |
| 1929 | $3 | $40 | 122.5 | 5% |
| 1947 | $589 | $1,862 | 155.0 | 2½% |

Similar calculations show that if we could reduce federal expenditures from $35 billion to $25 billion annually, raise interest rates by one-tenth and lower living costs by 15% — all realistic possibilities if we make the effort — then the income needed to build up such a retirement fund would come down to $9,500. The chances of realizing that goal would then be restored to what they were in 1929.

*Several other factors were omitted from the calculations because they would not have a decisive effect on the results. Thus, existence of social security pensions and retirement funds now reduces the income needed; but if state income taxes were added, the income needed would increase.

### Why Try to Succeed?

While the income needed for retirement today has increased 2½ times — or by more than 150% — since 1929, the average person's income has increased only 80%. So the average man's chances of achieving success are really slimmer now than a generation ago.

This 1929-47 trend is something new in America. The average person's chances of getting ahead improved during 1914-29. In that period the dollar income needed for retirement or a stake in business rose by 75%, but the average income rose by 100%. So more people were within striking distance of success and security in 1929 than in 1914. The story has been different since 1929.

Fewer people actually do achieve financial success today. Only 1% of all families now have incomes large enough to build up a retirement fund or a stake in business. In 1929 almost 6% of all families attained a comparable degree of success.

Higher taxes are the most important reason why it takes so much more now to build up a competence. They account for one-half the increase in the amount needed. The other half is explained by higher living costs and lower interest rates.

It is, of course, true that few people ever get into the higher income brackets. So the process of cutting

away the incentives which play such a key role in our economic system affects comparatively few people immediately. It does, however, have a powerful indirect effect on all of us.

### Everybody Loses

When half to four-fifths of any additional income of successful people goes to Uncle Sam a heavy drag is obviously put on doing the work to get it. Thus, we stand to lose the benefit of full use of the nation's best brains. By so doing we stifle industrial progress. And the loss in productive efficiency far outweighs the tax revenue the Treasury gains. Carried far enough, the process of stifling economic progress by slashing rewards leads straight to industrial stagnation.

The same process also multiplies the risks of embarking on new capital investment. High taxes rule out all but the most profitable new projects and restrict most expansions to boom times when profits are high. So capital investment follows a boom and bust pattern and, by so doing, contributes much to ups and downs in production and employment.

### The Sorry Plight of Britain

The case of Britain today provides an object lesson of how blighted incentives produce industrial stagnation. *Britain's number one economic problem is to get more production. But the tax load there is so heavy it stifles the incentive to produce more.*

A coal miner who works an extra shift pays about a third of his added earnings to the tax collector. And, as the London *Economist* comments, tax rates on business executives are so high that they kill every incentive except that to tax evasion. In short, not only is the incentive to succeed blighted, but so is the incentive to work.

*A root-cause of Britain's trouble is this: The cost of an expensive program of social benefits has been piled on top of the heavy costs of paying for past wars and trying to prevent future wars. Tax rates are boosted accordingly. What her experience proves is that the attempt to provide excessive social benefits may defeat itself. It raises the tax burden on rich and poor alike and smothers the incentive to work. So the underlying basis of all economic benefits—production—is eaten away.*

We in the U. S. haven't traveled as far down the stagnation road as Britain has. Taxes amount to about 26% of national income here as against about 45% there. But, unless we start soon to build up incentives to do better work, instead of whittling them away as we have been doing, we will catch up with Britain fast.

### It's Late but Not Too Late

Can anything be done? Decidedly yes, *particularly by tax reform and reduction in the cost of living.* As far as interest rates are concerned, any large increase would raise excessively the cost of carrying our war-swollen national debt, and hence raise taxes. But some increase in what are now excessively low interest rates may well be both feasible and desirable.

*Action on the tax front is the first order of business. Our jerry-built tax structure is the thing that is chiefly responsible for cutting the incentives to work harder.* Two things are important: 1) Government spending must be pared to the bone; 2) The tax system must be completely overhauled to remove the shackles on all-out production.

The 56th editorial in this series, published in March, outlined major steps that need to be taken in remodeling federal taxes in order to increase incentives to individual and business enterprise. *The revenue bill now before Congress is no more than a short step in the right direction. Much more must be done to clear the way for high production and rising living standards.*

Lifting the blight which taxes now place on incentives would help cut the high cost of living. It would stimulate greater production and greater efficiency. But a further step is necessary. Part of the benefits of improved efficiency must be passed on to consumers in the form of lower prices.

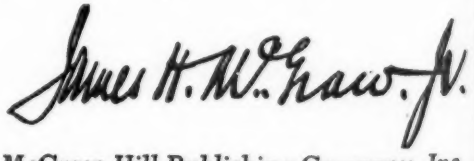
In the past few years we have been following precisely the opposite course. In many cases wages have been increased all out of proportion to increased productivity. Result—soaring prices and a severe squeeze of the consumer, to which some greedy exploitation of war-created shortages has also contributed.

### To Give Ability a Chance

Our basic and most crucial problem is to get back on the track which leads to higher production and improved living standards all along the line. We got off that track in the 30's. Then, we started scrambling for larger slices of the same pie instead of trying to produce a larger pie. Now the process of getting back on the track is greatly complicated by the tremendous tax burden growing out of the war.

Yet it's not too late to turn back from the road that leads to industrial stagnation. As the statement in the center of the page shows, we could restore the odds of getting ahead to what they were in 1929. Cutting the federal budget to $25 billion a year and putting the tax structure in good order are the crucial first steps.

By taking these steps soon, Congress can go far to restore the incentives to hard work and efficiency which have been so largely washed away in the past 20 years. If they are not taken the American dream of getting ahead by hard and effective work will exist only in the history books, and our children will inherit from us an economic order without opportunity, without hope, without individual liberty.



*President McGraw-Hill Publishing Company, Inc.*

# Flexible Shafts and Couplings Protect High-Speed Gears

**Severe vibration may develop rapidly in forced- and induced-draft fans because of wear from corrosive-erosive gas and air. R L Benford, gear engrg div, General Electric, outlines a combination to protect turbine and gears from damage**

▶ FORCED- AND INDUCED-DRAFT FANS for boiler service may subject their turbine and gear drives to severe operating conditions. The high-inertia rotors of the fans may have to be accelerated at a high rate, and they may get out of balance quickly because of rapid wear when handling corrosive and erosive air or gas. These conditions are frequently aggravated because the fans cannot be taken out of service long enough to inspect and balance them properly. To solve these problems high-speed gears were developed; special features are incorporated in them and the fan driving system.

When driving a modern induced- or forced-draft fan of good construction and aerodynamic design, adequately maintained turbine and gears can be expected to run smoothly and dependably for a long time. But some boiler fans, particularly the older designs, may become and remain badly out of balance. These units require special connections to their driving gears because conditions may develop from fan performance that endanger the driving equipment. The high-speed gears here described were developed to meet these conditions on existing fans that frequently cannot be held out of service long enough for proper balancing.

**Gear Design.** The best design and manufacturing know-how must be put in these gear units if they are to meet operating conditions successfully. The gear wheel and pinion must be precisely machined, hobbed, aligned and balanced for smooth and quiet running. Gear wheels are pressed and keyed on the low-speed shafts, and pinions are proportioned to limit deflection so that they make full contact across the gear face.

It is advisable to inclose and seal off the complete oil circuit from hot and dirty air in the fan room. Oversized oil pumps, coolers, strainers and tanks are safeguards against hot, dirty oil. Shaft seals, which cannot be completely protected from damage by violent vibration, are made for easy replacement.

Gear teeth, shaft and turbine are

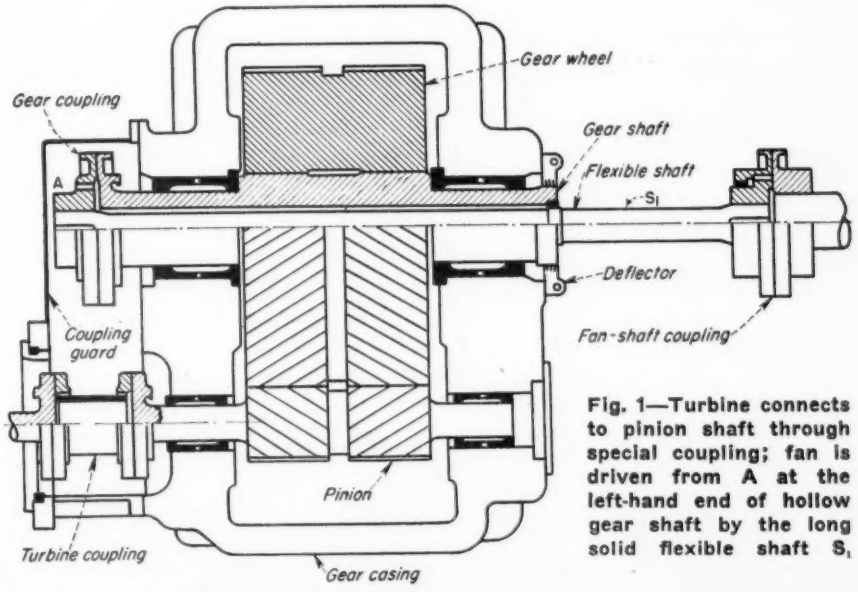



**Fig. 1—Turbine connects to pinion shaft through special coupling; fan is driven from A at the left-hand end of hollow gear shaft by the long solid flexible shaft $S_1$**

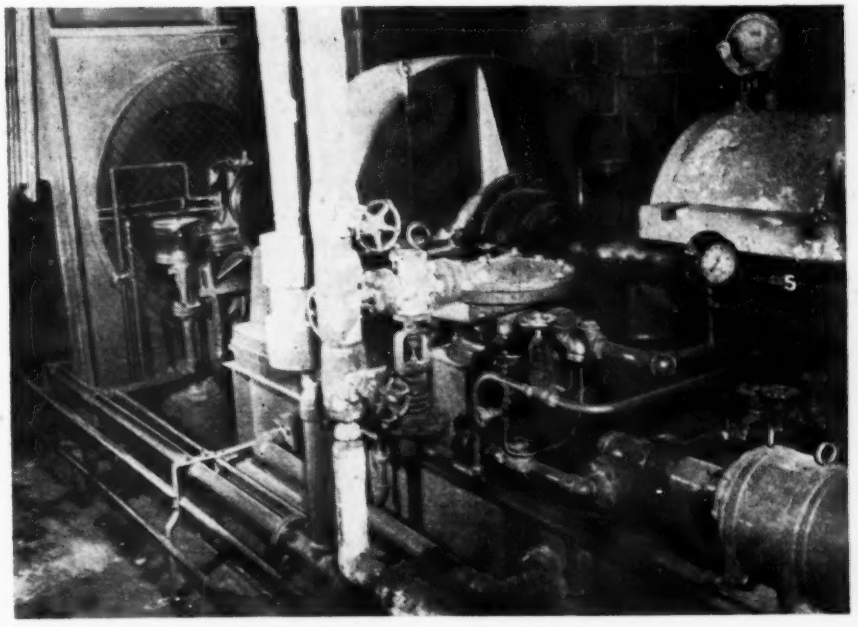


**Fig. 2—Turbine, right, coupled to double-end gear drive that connects through long, flexible shafts to two forced-draft fans, one on each side of drive unit**

isolated against heavy vibration by couplings and a special flexible shaft, Fig. 1. Gear-tooth couplings reduce fan-shaft vibration and deflection of the flexible shaft, which in turn keeps movement of the low-speed-gear shaft to a negligible amount. The coupling remains free while carrying high torques and transmits very little of the shaft's bending moment. Isolating vibration from the driving members insures smooth and steady application of torque from the gear-tooth mesh and turbine shaft.

**Flexible Shafts.** Reduction of vibration amplitude from fan to gear is improved by making the flexible connecting shaft as long and light as possible. The shaft, if comparatively long, has small angular deflection at its fixed end, for a given movement at the other. This free length can also absorb torsional shocks due to sudden acceleration or gas pulsations. Space is often limited for installing the driving equipment on single fans. In such installations the desired length of flexible shaft can be obtained by extending it through the hollow low-speed gear shaft, and coupling at the opposite end from the fan, Fig. 1.

The fan and its driving unit must be installed on a correctly designed foundation. It must be as massive and rigid as conditions allow to prevent transmission of fan vibration through the foundation to the gears and turbine. If the foundation transmits fan vibration, the latter impairs gear and turbine performance, and may produce damaging vibrations in other equipment far from the fan. It is useless to avoid vibration studiously through connected shafts if similar effects reach gear and turbine through their supports.

**Critical Speeds.** A flexible shaft between fan and gear sometimes drops the first torsional critical speed of the turbine-gear-fan system within the fan's operating speed range. To be flexible in twisting and light in vibration the shaft must have a comparatively small diameter, but be large enough to keep torsional stresses below expected endurance limits. This may require a high-strength steel shaft with smooth unbroken contours, free from grooves, fillets and surface scratches. The shaft often has to be made hollow to be of proper length for the machine layout, minimum diameter for allowable stresses, and to have torsional and lateral criticals outside the operating speed range. In any case, the designer should carefully tune the shaft to satisfy all conditions.

**Two-Fan Drives.** If the turbine drives two fans, Fig. 2 to 4, one from each end of the low-speed shaft, the flexible shafts must be suitably designed with reference to each other. The two fans will be identical, except for direction of rotation, but the spans from gear-coupling face to fan-coupling face will probably be different. The turbine-end fan-drive shaft is best made long enough in order to place this fan clear of the turbine casing.

Since the fans have equal inertias ($WR^2$) and torsional criticals should be avoided, make both shafts about the same in torsional stiffness. Matching of shaft stiffness and fan inertia on each side of the drive creates a node at the gear, which isolates at their source oscillations of either fan, so their disturbances will not cause hammering or pulsations in other equipment. The designer must know many things about the fans before he designs the flexible shafts, including fan-shaft proportions, fan $WR^2$, end-to-end spacing for double fans, complete operating speed range, and maximum torques.

**Rough-Running Fans.** Inclosed gears with flexible connections are suitable for driving rough-running fans in hot and dirty places. Couplings between fan and gear shaft are likely to wear when serving as vibration isolators. The wearing parts of the couplings are easily available for examination and removal. They are cheap enough for the operator to stock spares.

Shaft seals and oil deflectors also should be made accessible and be stocked for quick replacement if they wear out during violent vibrations. These seals keep oil and oil vapor in the gear casing, and keep out soot, fly ash and corrosive gases. Frequent examination of the oil system safeguards it from water, sludge and foreign matter.

With this type drive, fans may vibrate violently or pulsate, but the gear wheel, pinion, high-speed coupling and turbine shaft will continue to run smoothly for long periods. High-speed gears, suitably adapted, are an important part of heavy-duty fan drives.

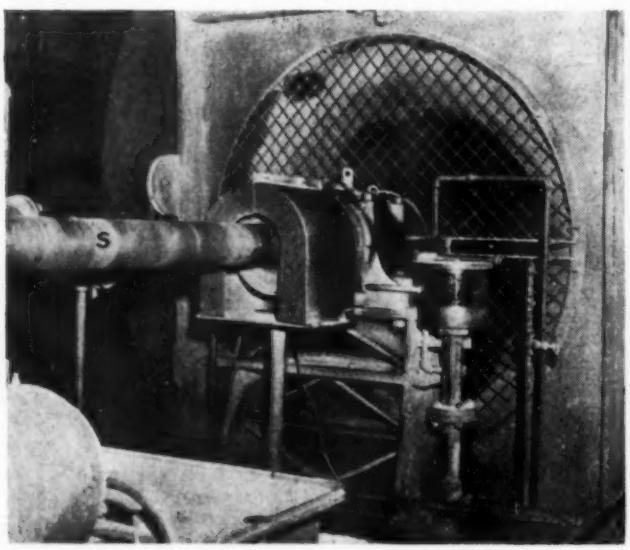



Fig. 3—Shaft S, Fig. 2, is long enough to place one f-d fan beyond turbine; it connects to the right-hand end of the gear shaft and to the fan by special flexible couplings

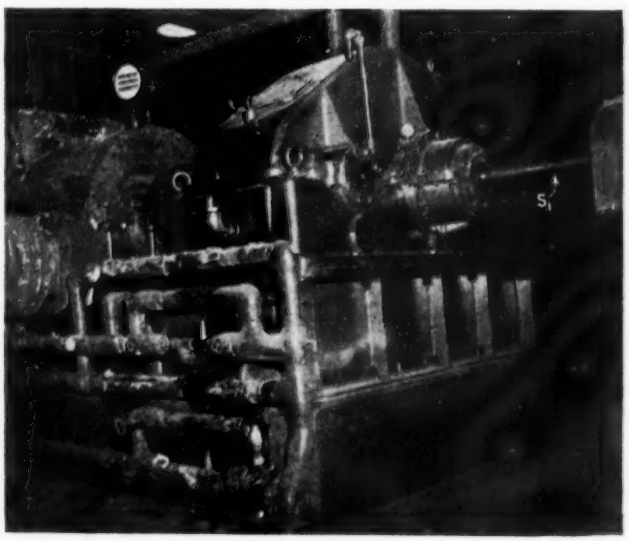



Fig. 4—Because shaft $S_1$ is shorter than S, Fig. 2 and 3 it is made equally flexible by a reduced diameter. It connects to the gear and fan by special flexible couplings

# Proper Water Treatment Licks Scale and Corrosion In Air-Conditioning Systems

**Most natural waters corrode metals and deposit scale. If these traits are not counteracted they will be intensified when water absorbs impurities from the air or evaporation concentrates dissolved salts already in the makeup**

By WILLIAM J RYAN,
*Technical Manager*
*Water Service Laboratories, Inc*

▶ AIR-CONDITIONING SYSTEMS are subject to corrosion of those pieces of equipment that come in contact with water—namely, spray chambers, cooling towers, condensers, heat exchangers, compressors, piping and pumps. In addition, the corrosion products may clog spray nozzles and impair the efficiency of heat-exchange apparatus. As dissimilar metals are commonly used in the assembly, galvanic action accelerates the corrosion rate.

Most natural waters are corrosive to metals. In air-conditioning systems the corrosiveness is greatly increased by impurities absorbed from the air, principally oxygen and carbon dioxide, and by sulphur dioxide present in flue gas discharged from smoke stacks. Circulating water in spray chambers and cooling towers tends to become acid rapidly because it absorbs these impurities.

**Scale Formation.** If water is hard—contains large amounts of calcium and magnesium salts—scale formation is also a problem. This action may be especially troublesome in refrigerant condenser cooling-water circuits where salts concentrate from the continual evaporation that takes place.

In addition to corrosive gases, water in the air washer and cooling tower (or evaporative condenser) absorbs particles of dust as well as bacteria, pollen and molds from the air. These materials form troublesome deposits that may impart odor to the air, substantially diminish the efficiency of heat-transfer surfaces, or contribute to the clogging of spray nozzles.

**Water Treatment.** Preventing corrosion, which results from the action of circulating water, involves (1) use of an alkaline substance to counteract continual absorption of acid gases from the air and (2) simultaneous use of a chemical passivist such as sodium chromate to protect the metal surfaces.

These chemicals are sometimes fed to water intermittently, but it is preferable to feed them at a rate proportional to the absorption of impurities from the air. Fig. 1 shows the installation of automatic proportioning feeds for introducing chemical solutions when the pumps are working and, therefore, when the air-conditioning system is in use. Rate of feeding is adjustable to compensate for the loss of chemical incident to overflow and blowdown.

In the system illustrated, the cold water that circulates through the air washers comes directly in contact with the air. In another design the cold water is passed through a bank of tubes in the spray chamber and circulates in a closed system; here spray water constitutes a separate circuit and has its own circulating pump.

The diagram shows the refrigerant-condenser cooling water being cooled by passage through a cooling tower on the building roof. An alternate arrangement uses an evaporative condenser instead of a cooling tower; or in small installations the water may run to waste

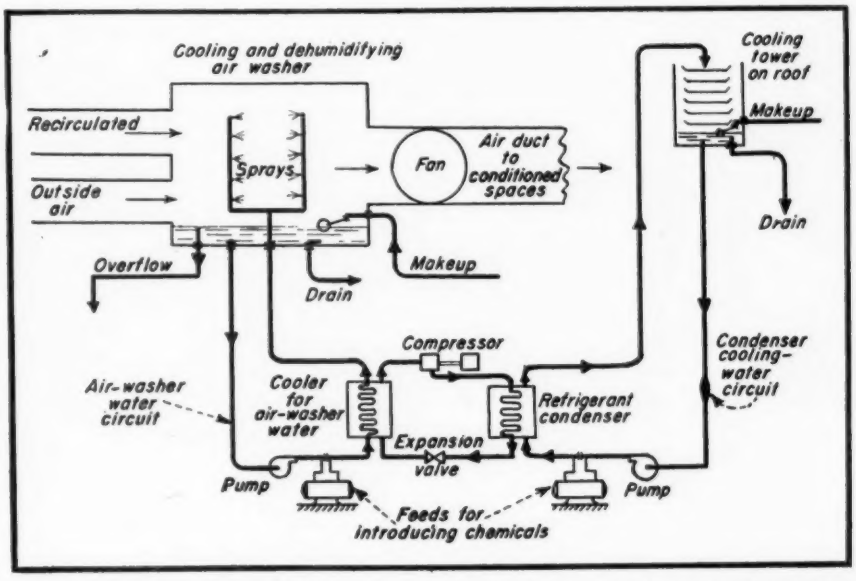



**Fig. 1—In this system chilled water to the washer comes in contact with the air. Another design passes the chilled water through a totally closed circuit**

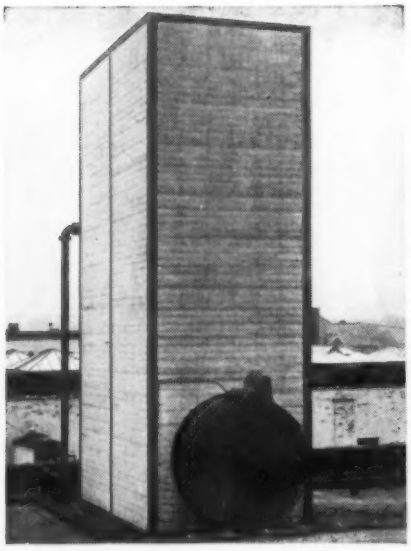


**Fig. 2—Cooling towers use surface-active agents to keep salts soluble**

instead of being cooled and reused.

To prevent scale formation in cooling towers and evaporative condensers in hard-water areas, common practice utilizes surface-active materials, such as certain polyphosphates, to increase the solubility of the scale-forming salts. Blowdown from the cooling-water circuit is regulated to limit salts concentration. Or makeup water to the system may be treated by passage through an ion-exchange softener.

Inhibition of organic growths from slime and algae is accomplished by treating water with germicidal agents such as chlorinated phenols, fed continuously in small amounts or intermittently in heavier doses. The germicide must be nontoxic, nonvolatile, and must not give the water an odor. The chromate used for corrosion prevention fulfills these requirements and may be effective as a germicide.

**Operating Precautions.** To supplement chemical treatment here are practical precautions in plant operation:

Keep ball cocks, or float valves, that admit makeup water to the circulating systems in good working order so water is not continuously entering and flowing out through the overflow, thus diluting the concentration of chemical. If possible, locate the overflow near the ball cock so any undetected in-leakage of water will have a minimum diluting effect.

Dirt and sediment, which accumulate in the spray chamber and cooling tower, should be cleaned out at periodic intervals.

Check pump operation carefully so there are no obstructions in the circulation and the pumps deliver the proper quantity of water. Inspect spray nozzles periodically to see that they are not clogged or partly obstructed.

# Heat and Cold From Same Compressed-Air Supply

► RESEARCH ENGINEERS at Westinghouse have built a novel "hot-cold" pipe, 15 in. long and 1 in. in diameter, that converts ordinary compressed air into both hot and cold air without the aid of moving parts. As yet scientists have no explanation for the phenomenon although they conjecture that the cause may be a frictional effect between gases moving at different velocities. The photo shows a working model of the device.

In operation compressed air enters at one end of the pipe through a nozzle. There it strikes the inner wall of the pipe tangentially to the diameter, which converts it into a whirlpool of spinning gases. Air in the center becomes cold almost instantly while that on the periphery gets warm. Cold air is drawn off through a ¼-in. opening at the center of one end, while warm air is tapped from the periphery.

R Hilsch, its German inventor, claims to have produced simultaneous jets at 154 and 10 F with an original tube 3/10 in. in diameter. The present model has purposely been constructed larger in diameter to expedite instrumentation for scientific study. For this reason it gives a temperature difference of only several degrees.

Low efficiency rules out commercial application at this time, but like the "blue glow" in Edison's experimental electric light that led to his invention of the first electronic tube, it may lead to unexpected developments. Even now the device holds promise as a handy laboratory tool for making cold as simply as a Bunsen burner makes heat.

**Warren Witzig, Westinghouse Research Laboratories, demonstrates hot-cold pipe. Warm air is drawn off (at left end), cold air comes from opposite end**

THE OPERATING ENGINEER

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS—ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

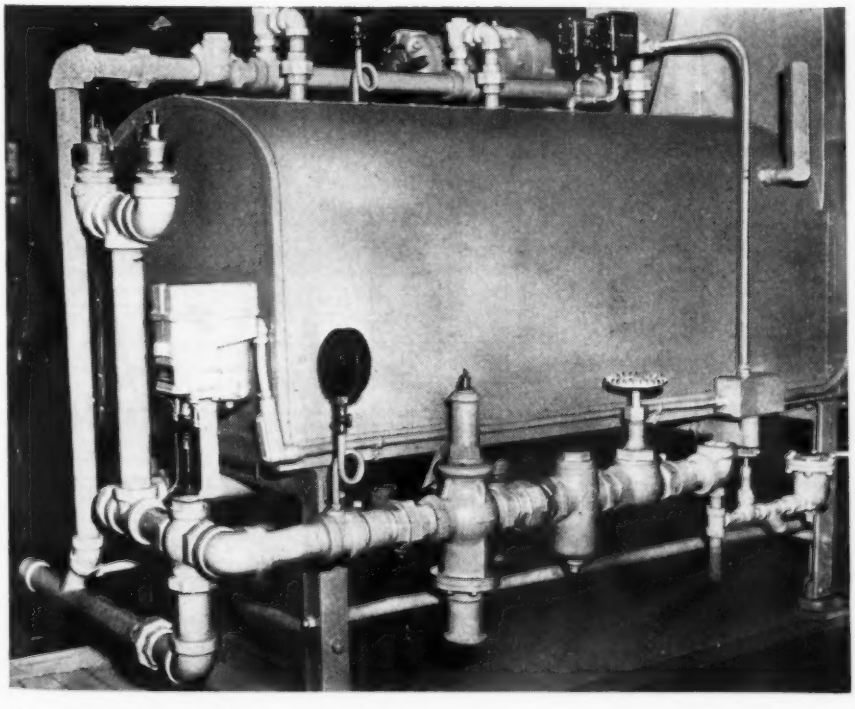
# Protect Your Low-Pressure Equipment

**How one user puts his low-pressure system under a series of safety tests. Harry M Spring describes these experiments and lists the findings, plus recommendations for proper safety**

▶ AN OLD AND ACCEPTED PRACTICE sanctions the operation of low-pressure equipment by steam taken from a high-pressure header through a reducing valve. But all too often such equipment suffers from a wrong and frequently applied assumption—that a safety valve of the same size as the low-pressure steam main provides protection.

This assumption is all too general. A letter to 15 important industrials (selected to represent a typical cross-section) asked this question: "Assuming that you pipe steam from an initial pressure of 140 psi through 1¼-in. pipe and a 1¼-in. pressure-reducing valve adjusted to supply steam at 20 psi, would you consider your low-pressure equipment adequately protected by a 1¼-in. safety valve set at 25 psi? Assume further that the low-pressure equipment is safe for 25-psi maximum pressure."

Fourteen chief engineers and company executives replied as follows: Eight, or 57%, believed the installation was safe. One was noncommittal. The remaining five, or 35%, felt the hypothetical installation unsafe. Each of these five had a method of correcting the condition different from the others.



A pre-boarding machine in a textile works using steam from a reducing valve. Tests indicate need for an orifice as well as regulating and safety valves

**Trial by Test.** One industrial plant, the Textile Machine Works of Reading, Pa. set up a series of tests because preliminary work in its engineering department convinced it that safety valves of the same size as the supply line could not control the pressure.

These tests employed a 2-in. pipeline carrying a supply pressure of 143 psi. The steam, after passing through a pressure-reducing valve, entered a 2-in. line into which had been connected a pressure gage and one of several safety-valve combinations under study, Fig. 1 and Table I.

**Test Results.** The first of these combinations had a single safety valve set at 30 psi, and of the same 2-in. size as the steam line. Under this setup, observed pressure (gage reading) reached 105 psi and, with the safety valve blowing, primary pressure fell to 135 psi.

For the second test, two safety valves of this same make and size were put in the low-pressure line and set to blow at 30 psi. This time, with both safety valves open, primary pressure dropped to 115 psi and the observed pressure became 70 psi.

The third test employed the same elements, but set the safety valves at 20 psi. Again with both safeties popping, primary pressure fell to 120 psi and the gage in the low-pressure line showed 87 psi.

Then a second manufacturer's safety valve of 2 in. size was connected in the test hookup to replace the two valves described above. With this valve popping at 20 psi, primary pressure became 130 psi and the gage reading showed 120 psi in the low-pressure line.

**Pressure Control.** Data from these tests confirmed the engineering depart-

ment's convictions that (1) safety valves of the same size as the line itself are inadequate (2) some means should be devised for properly controlling pressure under abnormal conditions.

**Test Elements.** With this objective in mind the same piping hookup—pressure-reducing valve, safety-valve size, pressure gage—was pressed into service. One element was added—a ⅝-in.-dia orifice. Its inclusion in each of the hookups resulted in a greatly improved pressure condition in the low-pressure line with safety valves blowing. These results, Table II, led to further testing with various-sized orifices until optimum conditions were determined. To prevent unnecessary hunting or pulsation of the reducing-valve mechanism a minimum orifice size of $\frac{21}{32}$-in. dia was established.

These investigations, conducted by G Bitzer, chief engineer of the Textile Machine Works, form the basis for the figures in Table III.

**Safety-Valve Size.** The next step, determination of proper size for safety valve, can be reached with the aid of Fig. 2. Curves shown are based on the assumption that steam has the properties of a perfect gas. For all practical purposes this assumption holds true since the slight superheating of steam in passing through the reducing valve is of little consequence.

A specimen case best illustrates the method of applying these curves in determining safety-valve size. If, for instance, a 1¼-in. line supplies steam at 100 psi to a pressure-reducing valve set at 15 psi what size safety valve (25-psi setting) is needed for adequate protection?

**Steps to Take.** Going then to the curves: (1) Pick off below the 100-psi gage-pressure point on the abscissa the corresponding volume of steam in cu ft per lb, or 3.88. (2) Follow up from the 100-psi point to the 25-psi pressure curve in the family of low-pressure curves, and cross over to the ordinate to get the corresponding volume of steam in cu ft per lb at that pressure, or 11.1. Take these figures, 11.1 and 3.8, and we find that 11.1 ÷ 3.8 gives 2.86, a comparison factor. This factor means the safety valve on the low-pressure side of the pressure-reducing valve should have a cross-sectional area at the inlet of 2.86 times the feed-pipe area, in this case 1¼ in.

With this factor or ratio of areas the diameter of the low-pressure pipe becomes $d = \sqrt{1.25^2 \times 2.86}$ or 2.1 in.

A 2½-in. safety valve is the nearest available size that permits strict adherence to the calculated size. Since a 2-in. safety valve comes so close to the required 2.1 in., it might be tolerated. (*Ed Note:* Good practice is to select a safety valve by discharge capacity rather than pipe size if no orifice is used.)

**Use Two Safety Valves.** The chief engineer and resident manager of the Philadelphia office of Mutual Boiler Insurance Co of Boston recommends the additional protection a 2-safety valve installation affords. Should such an installation seem desirable a different-size valve will be acceptable. It will be equal to $\sqrt{\frac{1.25^2 \times 2.86}{2}}$ or 1.4 in. dia. Nearest available size is 1½ in.

**TABLE I—TESTS CONDUCTED WITHOUT ORIFICE**

| | Primary pressure, psi | Steam line size, in. | No. of safety valves | Safety-valve setting | Observed press at blowoff |
|---|---|---|---|---|---|
| Case 1 | 143 | 2 | 1 | 30 | 105 |
| 2 | 143 | 2 | 2 | 30 | 70 |
| 3 | 143 | 2 | 2 | 20 | 87 |
| 4 | 143 | 2 | 1 | 20 | 120 |

**TABLE II—TESTS CONDUCTED WITH ORIFICE**

| | Primary pressure, psi | Steam line size, in. | No. of safety valves | Safety-valve setting | Observed press at blowoff |
|---|---|---|---|---|---|
| Case 1 | 143 | 2 | 1 | 30 | 45 |
| 2 | 143 | 2 | 2 | 30 | 30 |
| 3 | 143 | 2 | 2 | 20 | 20 |
| 4 | 143 | 2 | 1 | 20 | 55 |

**TABLE III—RESULTS OF INVESTIGATION**

*Conducted by Textile Machine Works*

| Boiler and line pressure, psig | Optimum orifice-dia size |
|---|---|
| 65 | 1 |
| 85 | 7/8 |
| 100 | 13/16 |
| 115 | 3/4 |
| 125 | 23/32 |
| 140 | 11/16 |
| 155 | 21/32 |

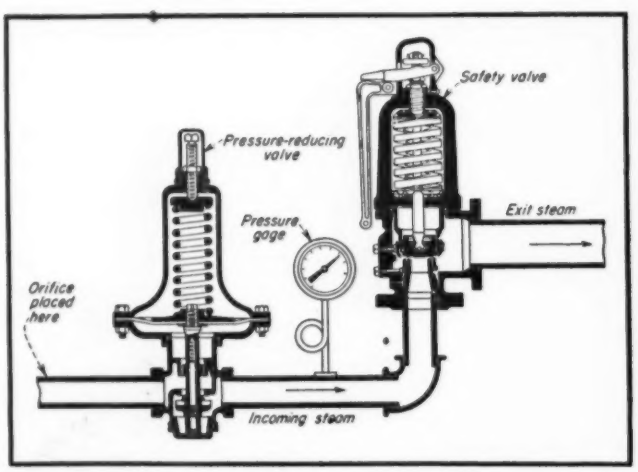



**Fig. 1—Piping hookup used in tests for protection afforded by various safety valves and orifice combinations**

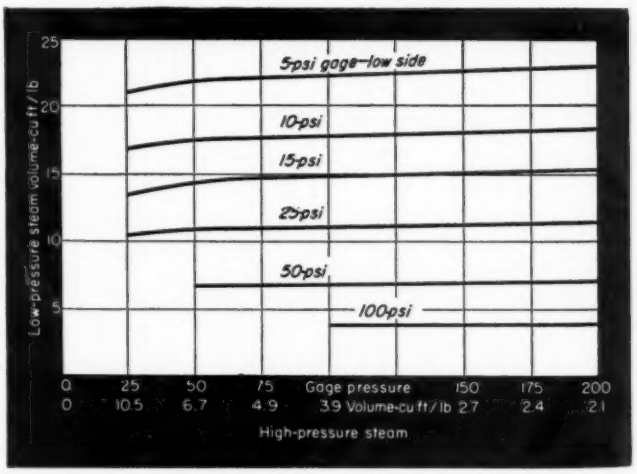



**Fig. 2—Family of low-pressure curves that help in the determination and selection of proper size safety valve**

**Separate Risers.** A good operating practice calls for separate, full-sized connections to each of these valves. A common riser of the same diameter as the safety valve may develop friction losses and a pressure build-up that reduces some of the protection.

There is still another acceptable method of safely controlling reduced pressures. This method involves a safety valve and a rupture diaphragm or safety head. The safety valve, set at not over the maximum allowable working pressure for the low-pressure equipment, can be of the same size as the pressure piping into which it is connected. The rupture diaphragm of an approved type supplements the safety valve. It is set at no more than 20% above the safety-valve setting. This 20% leeway gives ample margin in event of premature diaphragm failure from fatigue. The diaphragm should be at least as large as the piping.

**Test Under Load.** Actual test gives the only positive proof of the relief capacity and the protection it represents. To run such a test, first shut off the low-pressure equipment to spare it from any possible damage. Next, open wide the pressure-reducing valve and hold it open. With all safety valves blowing, a rise of not over 6% in the reduced pressure, as indicated by an accurate pressure gage, shows a properly protected system.

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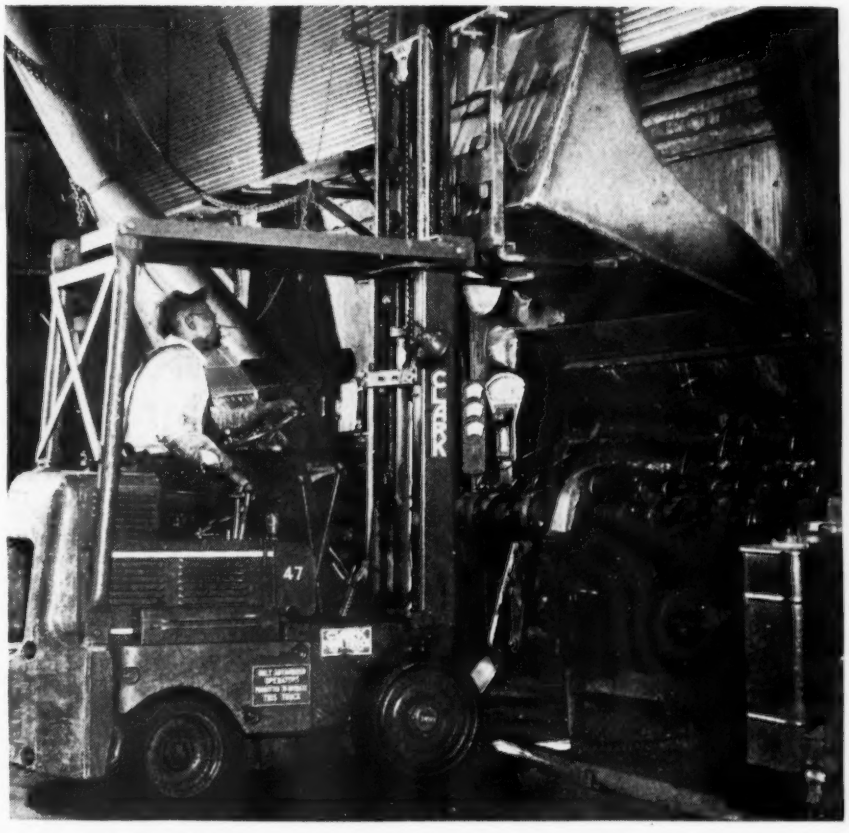
# A Shovel on Wheels Meets An Emergency

**When a conveyor breaks down during a weekend load quick action with available help must follow. Here's how one plant kept coal coming for three stoker-fired furnaces**




**Standard fork truck equipped with half-ton scoop supplies coal needs of three stoker-fired boilers. An overhead spout (left) had to be cleared away first**

▶A COAL-AND-ASH CONVEYOR at the Roanoke, Va. plant of the American Viscose Corp broke down one Sunday in the early morning hours. With the breakdown came a collapse in the coal supply and ash removal for a battery of three 40,000-lb-per-hr steam generators. These units require a coal supply at the rate of about a ton an hour, and of course a corresponding removal of ash resulting from combustion.

This battery of boilers supplies a segment of the plant load; without them at least a part of normal operation would shut down. To prevent this forced shutdown James Breakell, chief engineer, and William Paul, chief power plant operator, stepped into the breach. This is how they licked the problem.

**Overhead Bunkers.** The battery of three boilers affected by the loss of coal supply are stoker-fired units. Coal feeds from an overhead bunker through spreader spouts into the individual furnace hoppers. First step in improvising a coal feed involved closing the coal gates and then removing the spreader spouts. This action, by clearing the hoppers of any overhead obstruction, opened the way for an improvised coal-feed system. Manual feed was out of the question because there was not enough help to supply the needed coal to keep up steam pressure under load.

**Mobile Firing.** So Breakell and Paul pressed a standard fork truck into service. To this truck they attached a half-ton scoop as shown in the photo.

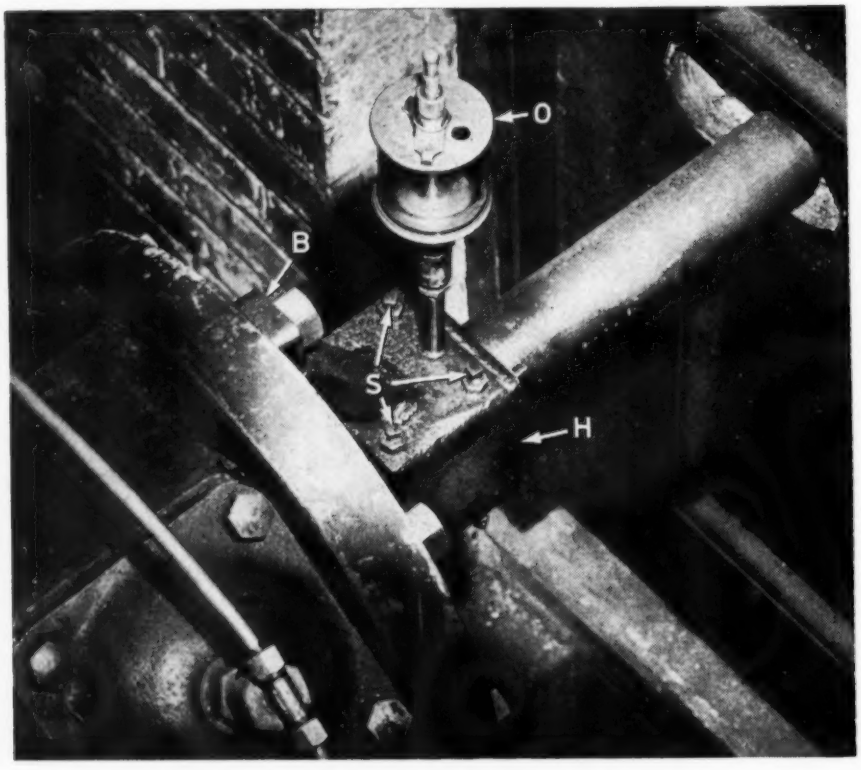
Loading involved lowering the scoop to floor level and thrusting it under a car-load of coal, previously brought to the boilerhouse door. The truck operator then backed off, raised the load and took it over to the hoppers of the three coal-starved boilers. (See above.)

This emergency feed system continued for three days with the only concession a reduction in load on the three boilers to the lowest permissible level.

Ash removal depended upon a crew of men with shovels and wheelbarrows working "around the clock." In all, 7-man gang handled both coal and ash removal for the three 24-hr operating days of the breakdown.

# PRACTICAL AIDS TO OPERATION

*Plant-Tested Methods and Ideas for Power Men*




## BEARING CURES AIR-CYLINDER TROUBLE

COMPRESSED AIR in our processes must be free of dirt and oil odors. To get away from cylinder lubrication we use an aluminum piston with carbon rings. The piston has a tailrod which, when first installed, passed through a brass bushing and several rings of square packing in the cylinder head. The bushing and packing were supposed to support the piston in its cylinder so the carbon rings had practically no load on them.

For some reason, probably lack of lubrication, the bushing wore quite fast and let down the piston so it rubbed the cylinder's bottom side. Carbon rings wore quickly and broke, and sometimes the pistons ruptured because of cutting into the cylinder wall. This made compressor maintenance difficult and expensive, besides seriously interrupting the air supply.

To correct this difficulty I built and installed an adjustable bearing on the tailrod, as in the photo. Top and bottom cylinder-head studs support this bearing, as at *B*. Inside housing *H* is a bronze bearing supported on four capscrews, *S*, at top and bottom. The bottom capscrews permit raising the bearing against the rod to hold the piston clear of the cylinder's wall. The top capscrews hold the bearing in place on the top side of the rod.

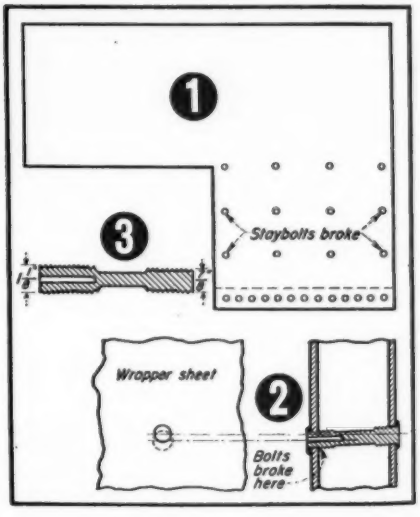
A sight-feed oiler *O* on the housing supplies a small amount of oil to lubricate the bearing correctly. As the load is light and the speed slow the bearing requires very little oil. It is necessary to keep lubricant to a minimum on this bearing so that it will not work along the tailrod to the packing and into the compressor. We welded the cylindrical guard around the tailrod to the bearing housing.

This bearing eliminated the trouble with the piston and carbon rings. Outside of slight periodic adjustments to make sure that it supports the piston the bearing has required no attention.

*Brooklyn, N. Y.* J P CAREY

## Misaligned Holes Cause Failure of Staybolts

A PLANT with only one boiler of firebox design had trouble with staybolts breaking in the front and rear ends of the water leg, as in Fig. 1. As the boiler was of ASME construction it was assumed that all Code requirements had been complied with. Several times we checked but did not find the causes of staybolt failures, such as cold feedwater,




cold-air blasts on the bolts, excessive firing, overload on boiler, staybolt material, scale conditions, and corrosion of boiler plates and bolts.

Then by chance we discovered the fault. Apparently when laying out the staybolt holes in the firebox and wrapper sheets, an error was made so the holes in the two sheets were not in line, as in Fig. 2. This put stresses in the bolts that caused their failure. The fault was corrected by enlarging the holes in the firebox sheet in a direction to bring them in line with those in the

wrapper sheet, and by using staybolts suited to the new hole size, Fig. 3.

Because the boiler carried an ASME stamp we assumed that its construction was correct. But someone's slip in this case shows that when looking for the cause of trouble nothing should be accepted as correct without first making a careful check.

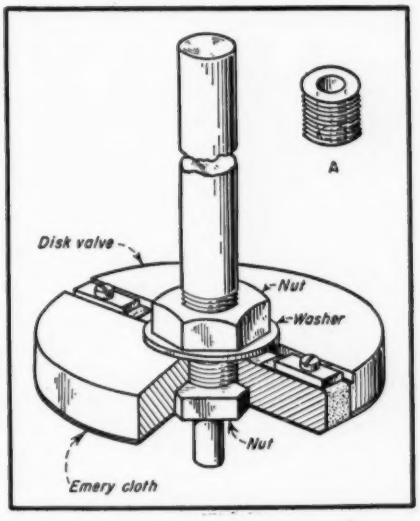
*Mt. Lebanon, Pa.* J J TIMMONS

## Tool Reseats Pump Valves in Place

THE DRAWING shows a reciprocating-pump valve refacing tool I made and have used several times to recondition valve seats without removing them from the valve deck. A valve disk forms the main part of the tool. This disk must be perfectly flat and true. On its under side, around the center hole in the disk, make a countersink about ¼ in. deep for a ½-in. hexagonal nut. Put the nut in a lathe and cut it to a thickness that fits flush in the countersink in the disk's under side.

In the top side of the disk cut a slot ⅜ in. wide and about ⅛ in. deep. About ½ in. from each end of this slot bore and tap a hole for a 10-24 machine screw. Make a spindle for the disk from a piece of cold-rolled steel. Put the spindle in a lathe and turn down a 1-in. section on its end to ¼-in. diameter. Thread this end of the spindle for about 2 in. up from the shoulder for the ½-in. hexagonal nut.

For a distance of about 1 in. on the end of a piece of ⅝-in. brass rod cut a thread that fits the stem hole in the valve seat. Bore a ¼-in. hole in the center of the threaded section, and cut it off. This section, shown at *A*, is screwed flush into the valve-stem hole in the seat, to act as a guide for the ¼-in. extension on the tool's stem.




To assemble the tool, thread the ½-in. nut on the stem and follow this with a washer. Thread the stem into thin nut on the bottom of the disk, and tighten the stem in place with the top nut. Cut a piece of No. 00 emery cloth a little larger than the disk. Leave a ⅜-in. tab on each side of the cloth long enough to swing up around the disk's edge and be held by the machine screws. Cut a ⅜-in. hole in the center of the emery cloth and fasten it to the disk's face. This tool is now ready for use and may be driven by a hand drill. Appropriate hand tools will remove any excess metal from the valve seat's center and web.

*Anoka, Minn.* HENRY GREINER

## BARBED WIRE PROTECTS TRANSFORMERS

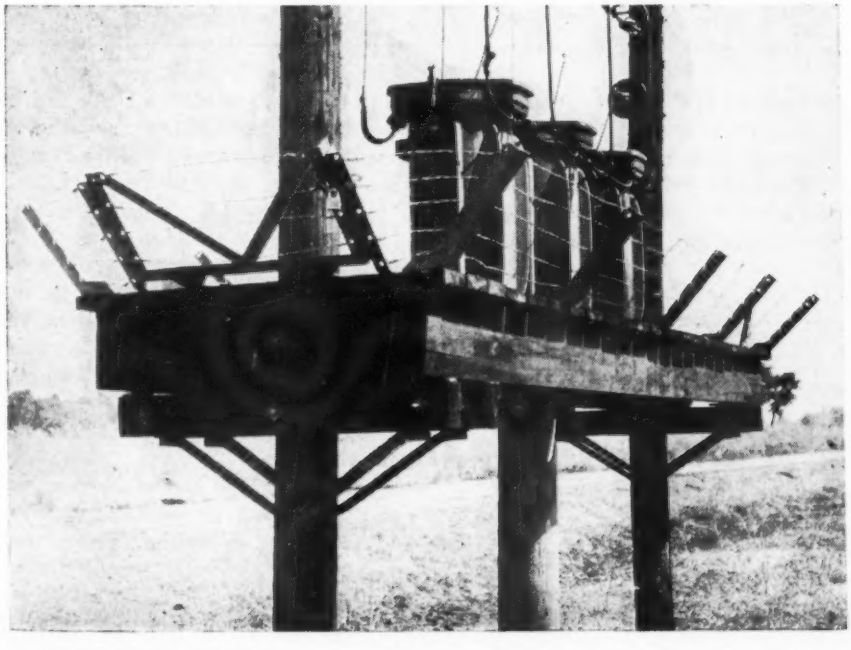
TO SAFEGUARD the transformer bank that stepped down line voltage to that required in one plant, the power company made the usual pole-platform installation, and then suggested that the user extend his fence to inclose the pole setting. Instead of building a fence, an inclosure was put around the platform, as in the photo. This effectively shuts off trespassers, but permits the transformers to be changed when necessary by the power company without disturbing the guard.

To make the inclosure, brackets were cut from 1½-in. angle iron, and bent at 45 deg so that a portion would extend out from the platform when the other end was bolted or screwed to the timbers. Five slits were then cut in the upper edge of the angle side of the brackets, and barbed wire strung in them. Next, the lip of the slit was peened down to retain the wire.

A gate at one end, hinged to swing down flat against the timbering, also carried barbed wire, and made an effective continuation of the inclosure when padlocked to the adjacent bracket.

The guards are painted bright red to call attention to the wires. They safeguard the transformer from molesters, and offer better protection than a high fence set on the ground.

*Houston, Texas* ELTON STERRETT



## Makes Split Sprockets For Roller-Chain Drives

FOR SOME YEARS we have made our large roller-chain sprockets. These are cast tooth, made in halves. Sprockets formerly were solid hub-and-rim design. This required taking down a shaft to change a worn sprocket, unless the latter was overhung. A sprocket made in halves is removed by unbolting it, and then the new one is bolted in place.

Some of the patterns are aluminum and others wood. We made the wood patterns of two layers with their grain

placed at right angles, glued and nailed together. This prevents having grain of the wood running across the teeth, and making it easy for them to chip off.

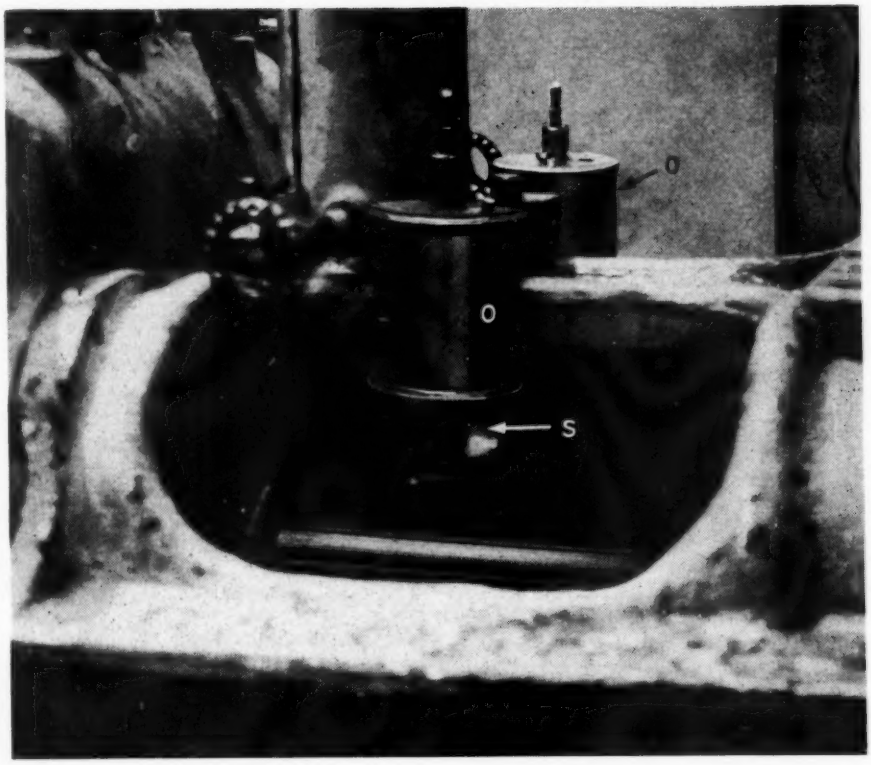
Start with the pattern stock a little larger in diameter than required and lay out pitch circle and outside-diameter circle. On the pitch circle accurately space centers for holes to form bottom of teeth. Bore holes a trifle oversize to take care of any slight inaccuracies. Trim pattern to diameter and shape teeth to proper form.

No allowance for shrinkage was made in the pattern, but it is advisable to make it slightly thinner than required. The molder sometimes raps the pattern too much in the mold. This makes the casting too thick, which requires removing excess metal from the sprockets' teeth and rim.

After the castings are made, a portable grinder cleans the teeth. The halves are finished to match, the splice plate holes drilled, and the halves bolted together. Chain side links make good splice plates. Chuck the sprocket in a lathe and bore for hub size and face the web where it bolts to hub flange.

We found that usually the old sprocket hubs could not be machined for mounting the new rims. We made the hubs from flanged shaft coupling finished to proper shape and size in a lathe. We have had no trouble with these sprockets, and they have given excellent service.

*Green Mt Falls, Colo* G M HARDY




## THESE DRIP OILERS LUBRICATE PACKING

IN ONE PLANT the fluids handled by a duplex reciprocating pump washed the lubricant from the stuffing-box packing, caused it to become dry and hard, and scored the piston rods. This difficulty was corrected by supplying oil to the rods so it is carried into the packing gland.

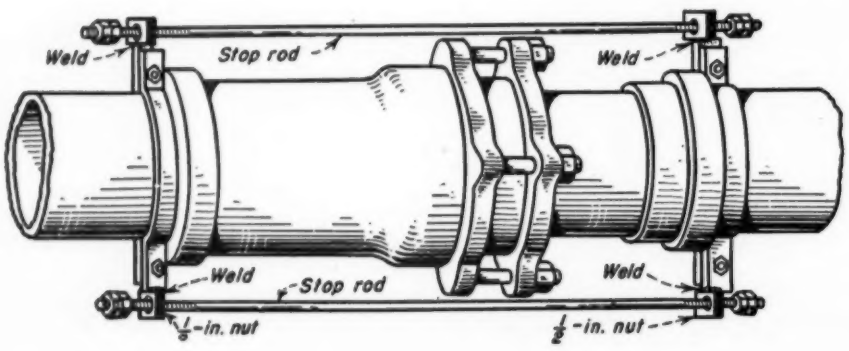
Two conventional half-pint sight-feed drip oilers *O* are attached to iron strap *S*, shaped to rest on the distance piece between fluid and steam ends of the pump. Oilers are set so that oil droplets leaving them fall only about an inch on the rods. Oil to wet the packing is adjusted in the usual manner common to all lubricators of this type. A bolt, threaded into a tapped hole in the distance piece, between the two ends of the pump holds the strap and oilers stationary.

*Santa Monica, Calif.* J C ALBRIGHT

## Stops Limit Movement Of Expansion Joint

OUR PLANT HAS several long steam lines anchored at each end. In the center of each line there is an expansion joint. Pipe expansion exceeded the movement permitted by the joint so the anchors were subject to stresses that bent them. This placed the anchor connection on the pipes far enough apart to endanger pulling the expansion joints apart when the pipes cooled.

The anchors should have been rebuilt to limit pipe expansion and contraction to that permitted by the expansion joint. This would have been difficult and expensive, so I decided to put stops on the expansion joints to keep their movement within safe limits.




I made these stops from ⅜x2-in. steel bars. bent to fit around the pipe. To one end of each bar I welded a ½-in. nut to form a clearance hole for a ⅜-in. rod. Each stop is made in two halves, and bolts around the pipe at each end of the expansion joint, as in the diagram. The two stop rods are about 6 in. longer than the space between clamps when the pipe is hot.

Nuts are locked on the threaded end of the rods to limit joint movement to a safe amount. When the pipe contracts this amount, the rods prevent further movement of the joint. Moreover, any additional contraction is transmitted to

the anchors, which have some flexibility. When correctly adjusted these stops solved our problem without requiring attention or maintenance by the operating mechanics.

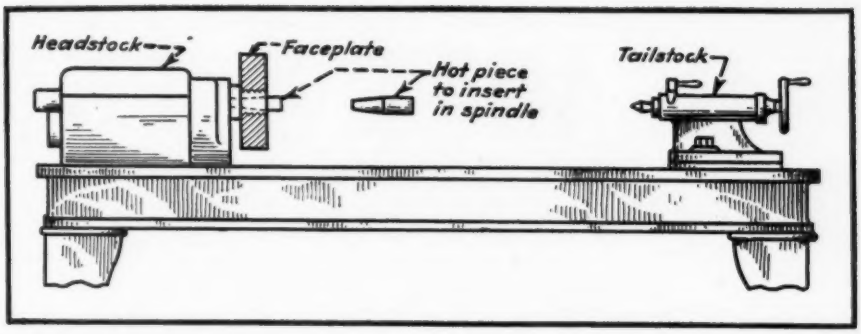
*Brooklyn, N. Y.* JAMES P CAREY

## A Little Heat Loosens the Faceplate of Lathe

TO UNSCREW THE FACEPLATE from a lathe spindle may require force great enough to damage the back gears. I found this condition recently, and was about to cut the faceplate off the spindle when I got the idea that heating the latter might help. I made a tapered plug, heated it to a red heat, and inserted it in the end of the spindle as in the figure. After leaving the plug in the spindle for a short time the faceplate came off easily.

When a faceplate is difficult to remove it probably was put on a hot spindle. Because of its temperature the spindle's end is expanded when the faceplate is screwed on tight. During cooling, the spindle shrinks and pulls the faceplate hard against the spindle's shoulder and threads. A little internal heating expands the spindle's end and releases the faceplate on the lathe spindle.

HERMAN E JOHNSON SR
*Garwood, N. J.*



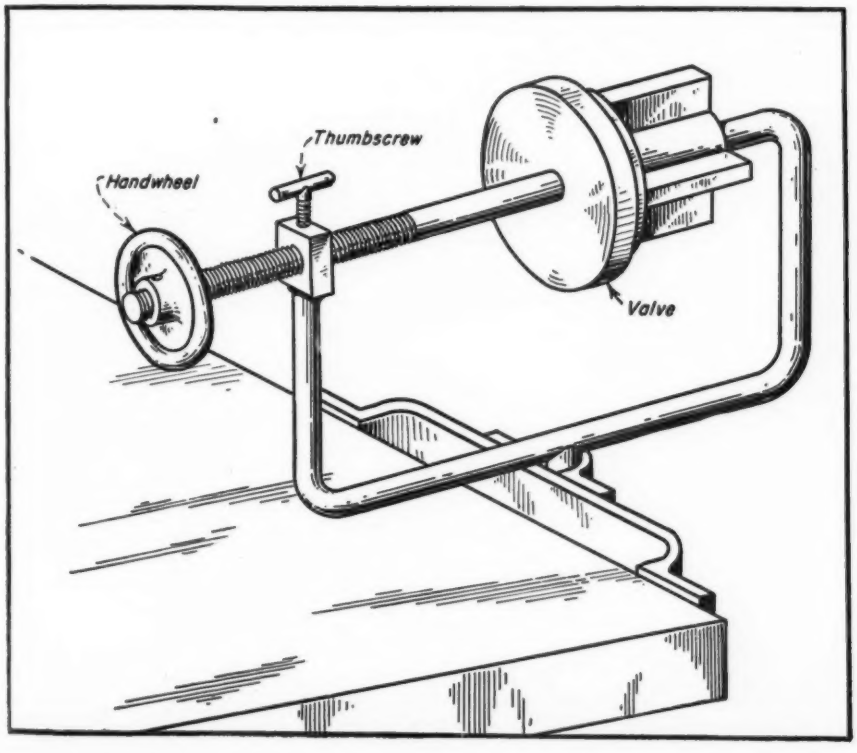

## REFACING JIG FOR PUMP VALVES

IN ONE SHOP the job of resurfacing pump valves and their wing guides was made easier by the welder when he built a jig to hold these parts during welding, as in the drawing. This jig has a frame, shaped like that of a hacksaw, made of a piece of ¾-in. steel rod. One end of this frame is finished with a point, ground and hardened to fit the center between the guide wings.

The other end of the frame has a ¾-in. nut welded to it, into which is threaded the pointed adjusting bar for holding the valve against the pivot point. Top side of the nut is bored and tapped for a thumbscrew, which locks the bar in place.

A small handwheel, threaded and pinned to the end of the adjusting bar, assists in turning it to position the valve. The frame may be fixed in a vise or in a bracket on the end of the welder's bench, as shown.

*Chicago, Ill.* CHAS A ARMSTRONG




## End Thrust Adds a Mystery to Hot Bearing

MANY CONDITIONS cause hot bearings. They are produced a surprising number of times on motors, particularly the induction type, because the rotor core is out of line with the stator core. A small misalignment of the rotor core with the stator bore produces a heavy end thrust to pull the two into line. If one of the bearings has to take this thrust it will overheat because of the friction between the shaft's shoulder and the bearing's end.

One bearing on a motor, when first installed in our plant, ran very hot. The motor was needed badly so we managed to keep it in service by blowing a fan on the faulty bearing and using lubricating oil liberally. Then one day we discovered that the bearing's temperature was normal.

This sudden drop in temperature remained a mystery until we could shut the machine down long enough to dismantle it for a thorough inspection. We found evidence of one shaft collar rubbing hard on the bearing and also that the rotor core had shifted endwise on its shaft toward the bearing.

Apparently the shaft had been pulled against the bearing with sufficient force to slip the rotor on it. When this happened pressure on the bearing was reduced as well as its temperature.

Slipping of the rotor core on the shaft was probably not caused by a steady thrust. But when the motor stopped the rotor moved endwise away from the hot bearing. When it started again the rotor was pulled against the bearing with a hammer blow sufficient to cause the core to slip on the shaft.

*Philadelphia, Pa.* S O SMITH

# READER'S PROBLEMS

Exercise your engineering wits by submitting answers to these questions fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

## 1—Can I Make Power and Heat With Exhaust Steam?

WE ARE PLANNING an expansion to our building, and I am gathering data on the power requirements. At present, we purchase electric power for a 30-kw light and power load. Power bill runs about $85 per month.

We have two boilers: One is a low-pressure unit for heating. The other, a 300-sq-ft 125-psi "Economic," furnishes steam for hot water and laundry; it also supplies low-pressure steam for heating some of the rooms. We burn 350 to 400 tons of coal a year, for which we pay about $8 per ton. Plans call for enlarging our building from 154,300 cu ft to 300,000.

I would like to know whether we can generate our power and heat the building economically with exhaust steam. Our plant is in northern New England where a temperature of 10 below is not uncommon. I estimate that 50 kw of power will supply the load to start, although this amount might increase over a period of years. Can we use our present boilers, or will we have to purchase a complete new plant? How many cu ft of room volume can be heated per sq ft of radiator surface? Can someone tell me about how much steam is required?

If POWER readers can answer these questions, the information will help me sell the idea to the management before plans crystallize. Charts or diagrams of similar plants might help me put over my arguments.—*AHP*

## 2—What Is Best Way to Save Engine Cooling Water?

IN THE PAST we have always dumped the jacket cooling water from our two diesel engines. I would now like to store part of this water in a 1000-gal tank on the roof, and use it in a small laundry. If we let the water flow into the tank at the top, and also overflow from the top, we won't get much hot water into the tank for storage.

I know that the engine jackets cannot stand full pressure; therefore city pressure cannot be used to force hot water into tank. What is best method of getting water into the tank? How should it be circulated to maintain it at the hottest temperature?—*RCE*

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## Answers to April Questions

### Is River Water Cheaper Than City Water?

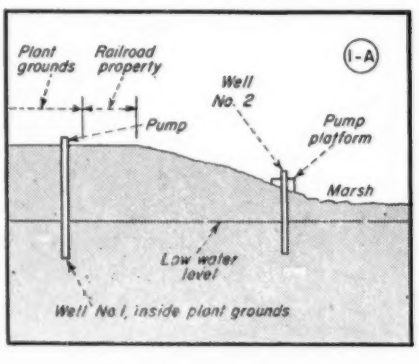
*(This is Question 1 from the April issue, with best answers from readers.)*

IN OUR FOUNDRY AND SHOP *we use about* 1,400,000 *gal per month of city water for cooling and heat-absorbing purposes. We pay* $1.50 *per* 1000 *cu ft. After looking for a cheaper source we thought of using river water, which is about* 2000 *ft from our plant. A railroad passes between our grounds and the river, and there is also some swampy land. Our plant floor is about* 30 *ft above low-water level in the river.*

*Can* POWER *readers advise me whether pumping river water is practicable and more economical than city water? I also want to know whether the pump has to be at the river—this requires a power line—or whether we can install it in a pit near the plant. Should we have two pumps of half capacity, or one of full capacity since no storage is planned? We estimate that a* 100-*gpm pump will be large enough if only one is used. What size and type of pump should be considered? How big should my pipeline be? I would also like to see a good layout for such a system, if any one has had similar installation experience.—CB*

### Drill Well for Water

FROM DATA SUPPLIED, along with the fact that *CB's* water bill is about $3400 per year, I say that pumping river water is worth investigating.



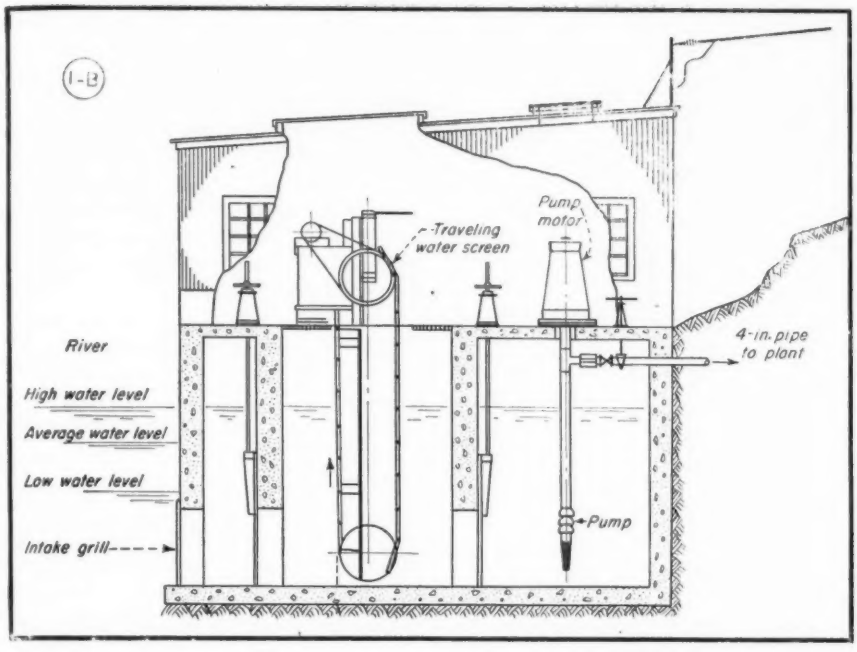

First, investigate possibility of a water-bearing stratum under the plant. This is suggested by the marshy ground and the river. If test borings prove this guess correct, drill a well at position No. 1, Fig. 1-*A*. If borings fail to show water, repeat at No. 2 near the swamp. If the test proves favorable, locate well here as second choice.

If there is still no water, set pumps in the river on a platform of piles far enough offshore for immersion of pump inlet below low-water level, and for clearance above river bed.

*CB* does not say whether the water demand fluctuates, and how many hours per day the plant operates. A 100-gpm pump, operating 9 hours per day, 26 days a month, delivers 1,404,000 gal. This is almost exactly his monthly requirement. Any variation requires a change in pump capacity.

Even though he plans no storage, *CB* should investigate the desirability of an overhead tank to: (1) Reduce insurance rates (2) use a smaller pump with float control (3) have water available to meet variable demands (4) use water for other purposes to offset the cost. (5) cooperate with neighboring plants.

*Los Angeles, Calif.* H T LIVINGSTON




## Analyze River Water

IN DECIDING whether to use city water or develop a pumping system, consider fixed costs, including: (1) equipment (2) piping (3) installation (4) construction (5) depreciation (6) insurance. Next, consider variable or operating costs: (1) power (2) water treatment (3) maintenance.

First, determine whether river water would have ill effects on process. Evidently *CB* uses city water that has been purified and treated. If the river supply is saline he should rule out this source as salt water corrodes piping and equipment, and is not recommended for his process.

Impurities in river water are either suspended or dissolved. Dissolved solids cannot be removed by filtration. What *CB* needs is water that is neither scale forming nor corrosive.

An analysis should determine just what treatment is required, if any; otherwise trouble may result.

If river water contains debris, a traveling screen, as in 1-*B*, is necessary. Install two 100-gpm units—one as standby. Drive each pump with a 10-hp squirrel-cage motor.

A 4-in. pipeline of welded steel would give greatest flexibility. Protect pipe against corrosion by an asphalt coating, and bury it at least 4 ft to guard against freezing. A pressure-regulating valve at the base of an elevated storage tank, if used, is also recommended. Retain city water for fire-fighting purposes.

If fixed and operating costs can be evaluated so cost per million gallons pumped falls between $10 and $50, raw water is fairly cheap. Without filtration but with simple chlorination and phosphate treatment, cost of river water is reasonable at $25 per million gallons.

*Cliffside Park, N. J.* J D CONSTANCE

## Adjust Pump Size To Fit Plant Needs

PUMPING RIVER WATER for *CB's* cooling systems is practicable, but whether it would be economical depends upon: (1) how much the installation will cost (2) how quick a payout he expects on investment. Establishing these conditions and investigating the local situation should give the right answer.

The pump has to be at the river, as in sketch 1-*C*. Since his floor is 30 ft above low water, locating the unit at the plant would require 2000 ft of suction line 30 ft deep because the water must flow in from the river.

Provide two pumps at full capacity if uninterrupted service is essential. But a 100-gpm pump would operate only 233 hr a month, or 9 hr a day for 26 days to pump the 1,400,000 gal. This should allow time for maintenance after hours and weekends. Therefore, installing only one pump would not be an unreasonable risk. City water should be retained as standby if sudden power failure or breakdown occurs.

Consider size of pump and line together. If 100 gpm is required, *CB* should get a pump good for, say, 120 gpm to take care of gradual fouling of his pipeline.

As for service conditions, I assume about 50 psi is required at the plant, that is 116-ft head. His static head is 30 ft; in addition, the pump must overcome full flow line friction. Below are factors entering into choice of pump and line size; assume 2200 ft of line to include loss in elbows, valves and fittings.

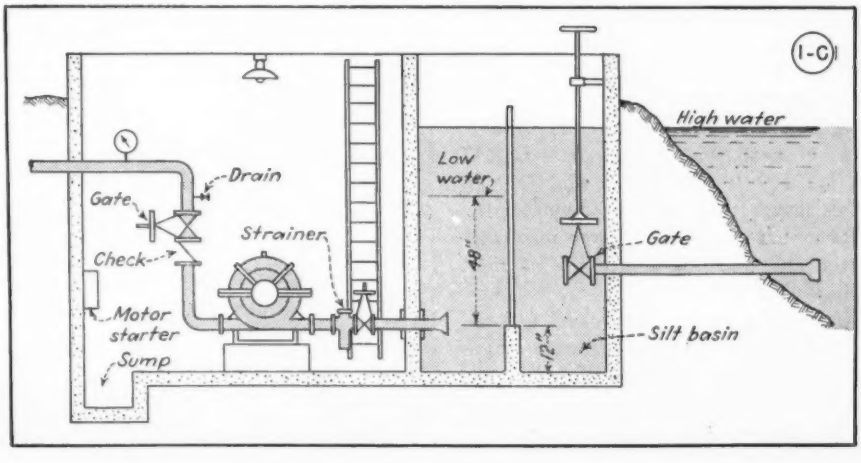
| | *Discharge pipe size* 3-in. | 4-in. | 6-in. |
|---|---|---|---|
| Loss of head, ft | 154 | 38 | 6 |
| Static head, ft | 30 | 30 | 30 |
| Plant pressure, ft | 116 | 116 | 116 |
| Total head (H) on pump, ft | 300 | 184 | 152 |
| Pump size, in. | 1½–2 | 1½ | 1½ |
| No. of stages | 2 | 1 | 1 |
| Efficiency (E), % | 60 | 64 | 63 |
| Bhp required $\frac{\text{Gpm} \times \text{H}}{3960 \times \text{E}}$ | 15.1 | 8.7 | 7.3 |
| Motor hp | 20 | 10 | 7½ |

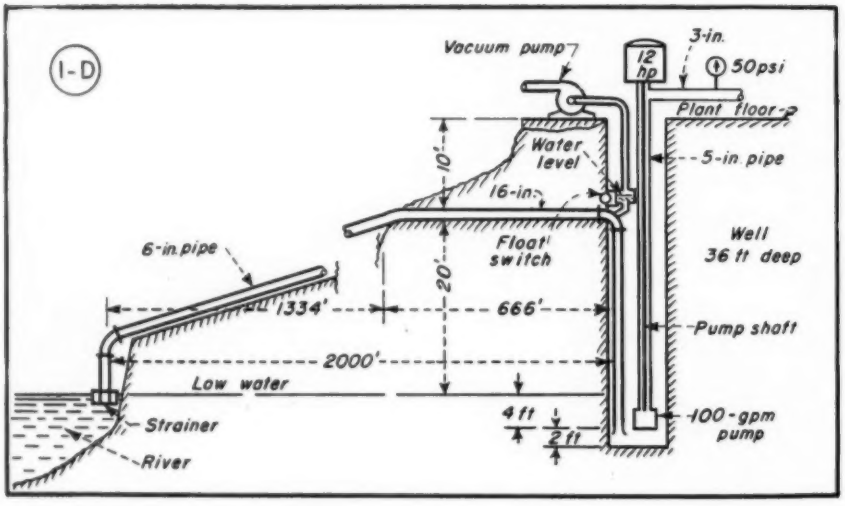
*Vancouver, B. C.* J S BALL

## Drill Well at Plant

NEARNESS OF THE RIVER and the presence of a swamp add to the ease of installing a well and pumping system. *CB* should put pumping pit and well just outside the plant. Use a good centrifugal pump with capacity of 125-150 gpm and install another pump in parallel for standby.

He plans no storage tank, but I think a tank of 5000-gal capacity would help






during peak periods. Our plant in the Gibbons Hotel has an 8-in. main from pumps to tank. Tank pressure is kept up by air pressure at 75 psi. We have a city water main coming into the building, but it is seldom turned on. Our well is 120 ft deep and we use an average of 55,000 gal of water daily. We maintain and operate a laundry, watercooled air-conditioning systems in restaurant and bar, and supply daily needs of hotel guests. The savings have paid for our system many times over.

*Dayton, Ohio* JOHN KIRIAKOU

## Siphon and Deepwell Pump Make Good System

WHEN BRINGING WATER from a distance, where it is inconvenient to install a pump, use the system in sketch 1-*D*. The siphon line follows the topography to a point 20 ft above the low-water level of the river, then runs horizontally through a trench to a well at the plant. If the 30-ft rise from river to plant is uniform, one third the distance, or 666 ft of the siphon line, will be underground at an average depth of 5 ft.

A 20-ft lift is good up to 500 ft above sea level. For every additional 1000 ft above sea level, the siphon lift must be reduced by 1 ft.

Using a 6-in. line for the siphon, loss of head for 100-gpm flow is 0.17 ft per 100 ft, or 3.4 for the 2000 ft. This means the discharge spout of the siphon has to be 4 ft below low-water level, and fixes the well depth at 36 ft below plant floor.

A vacuum pump is required to keep the float box, which is located at highest point of the siphon, half full.

A right of way can be secured to run the line under the railroad; in crossing swampy land the line can be laid under water or supported above it.

Since city water is available as standby, only one pump should be used. A deep-well pump is recommended. Pipe sizes are shown on sketch.

Monthly water requirements of 1,400,000 gal, give an average load of 33 gpm, so capacity of a 100-gpm pump should be sufficient. Because the average horsepower required is 4 select a 12-hp motor for full-load operation. The annual power consumption will be 26,000 kwhr which, at 1.5c per kwhr, will be $400.

The monthly 190,000 cu ft at $1.50 per 1000 cu ft is $280 per month, or $3400 per year. The apparent saving of $3000 ($3400 — 400) might be completely wiped off by the investment.

*Dorchester, Mass.* N T PEF

## Use 6-In. Main And Two Pumps

I HAVE MADE several assumptions in working out *CB's* problem. If the foundry operates 8 hr a day, 26 days a month, average demand equals 112 gpm. Maximum demand, which is about twice average, is 224 gpm. Probably two 100-gpm pumps would satisfy this demand, so costs are worked out on that basis.

Difference in floor and water level makes it uneconomical to locate the pumps in a pit near the foundry because of the deep excavation.

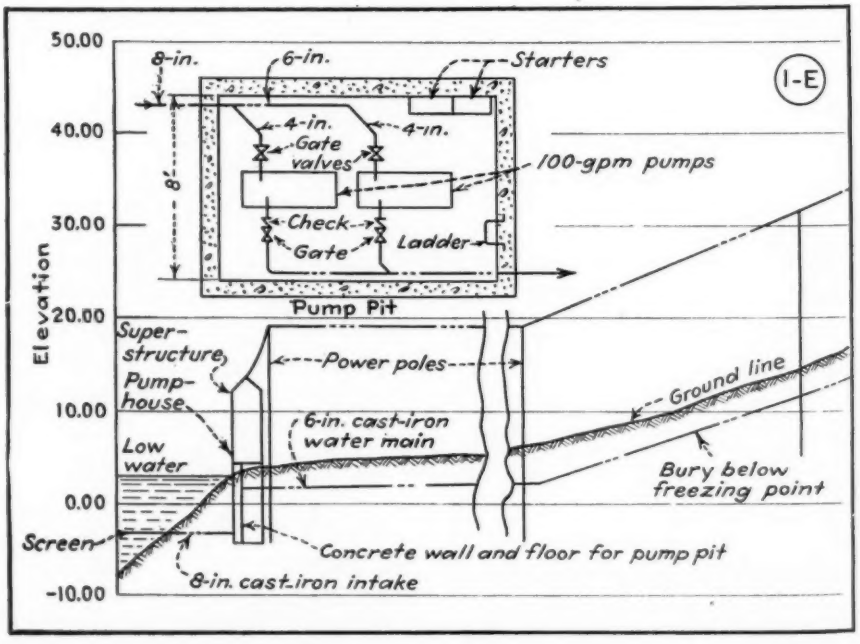
Use an 8-in. cast-iron pipe for intake. Fit the end with a bell-mouth and screen to keep out trash, and place it not less than 3 ft. below low-water level. Floor of pump pit should not be less than 4 ft below low-water level, as in 1-*E*.

Use a 6-in, main from pump station to foundry. Losses for 200 gpm in the 6-in. main from pumps to foundry are 12.67 ft. Assume water pressure at the foundry to be 45 psi. This equals a static head of 104 ft, plus the difference of 30 ft between the low water at the river and floor level of the foundry. Total pressure head will be: 104 + 30 + 12.67 = 146.67 ft.

Assume a total cost of $9000. Interest on investment, maintenance, operation and insurance at 8% annually is $720.

If power costs 1.5c per kwhr, over-all efficiency of pumps and motors is 70%; then cost of pumping against a 150-ft head is $168 per year. Total cost for

(*Continued on page* 154)



## How Often Should I Test Insulation Resistance?

*(This is Question 2 from the April issue, with best answers from readers.)*

WE WANT TO MAKE *insulation tests periodically in our industrial plant, which has a connected motor load of 4000 hp.*

*There are a few motors below 5 hp that operate at 110 and 220 v. Motors larger than 5 hp operate at 440 v. Rating of our largest motor is 600 hp. Power is distributed at 440-v, 3-phase. There are three 50-kva 440-to-110/220-v transformers for lighting and small motors. Most circuits are run in iron conduit although we have a few aerial feeders. Power is received at 22 kv, and stepped down in two banks of oil-insulated transformers, each rated at 1500 kva, 22,000-440 v. Two 25-kv oil circuit breakers provide protection. All sub-station equipment belongs to us.*

*We would appreciate suggestions on the frequency at which insulation tests should be made on our transformers, motors, starting compensators, lighting and power circuits, and on 440-v automatic control circuits. Some of our motors are controlled by relays and contactors and we want to keep this equipment in good condition. Also please suggest minimum resistance values for the equipment.—RG*

## Use Permanent Records For Insulation Tests

A REQUEST such as *RG* submitted really delights an engineer. It shows some individuals are preventive-maintenance conscious and want to keep their equipment in good condition. *RG* must appreciate that location, service and operation may require a modification of inspections and tests as well as the minimum values specified regardless of who specified them. Without on-the-spot information, an engineer can only give *RG* his own experience, to be used as seems best.

The following conditions alter recommendations: excessive ambient temperatures (above 40 C); frequent operation at high overloads; exposure to chemical fumes, gritty or conducting dust, lint, steam, oil vapor, salt air; vibration from extraneous sources; damp or poorly ventilated locations.

I recommend setting up a program of tests at definite intervals, and making changes after reviewing results of several periods.

As an initial program, set up yearly insulation-resistance tests and inspections for all circuits and equipment, except the oil circuit breakers. It is desirable to check this apparatus every six months if operation gets repetitive.

All circuits, motors, compensators, transformers from 110 to 440 v, relays and contactors use 1.0 megohm as the minimum allowable "in-service" insulation-resistance value. Desirable values for this equipment, after maintenance, adjustment or repairs, should be 5.0 megohms.

The oil circuit breakers and 440- to 22,000-v transformers use 25 megohms as the minimum allowable in-service insulation-resistance value and a desirable value of 50 megohms after reconditioning or repairs are completed.

Fig. 2-*A* and *B* show 5x8-in. record cards for motors and transformers, respectively. Note that both front and back of cards give pertinent information about equipment, rating data, parts-replacement data as well as a record of equipment service and inspections. For example, on the back of the motor card a column lists in megohms the insulation resistance of the stator winding. Next column notes condition of coils: dry, dirty, oil soaked, eroded at slot edges, loose wedges, frayed, etc. Then, too, some more important items of the motor are checked at this time—coupling, bearings, connection leads and air gap.

A high value of insulation resistance usually shows clean and dry insulation. But it does not always indicate that insulation is good mechanically and physically.

Low values or sudden changes in insulation resistance naturally demand investigation to determine cause. Insulation resistance usually includes two leakage paths in parallel, one through the insulation, the other over the surface. The values of insulation resistance are a function of ambient temperature, moisture, dirt present, type (class A or B), and assembly of insulation.

*Tenafly, N. J.* K B HOFFMAN

## Insulation-Resistance Change Most Significant

IN DECIDING the frequency of making insulation-resistance tests on electrical

(*Continued on page* 166)

Fig. 2-A

MOTOR RECORD (Front)

Location _____ HP _____ S/N _____ MFR. _____

TYPE _____ FORM _____ VOLTS _____ AMPS _____ CYCLES _____ PHASE _____

PF _____ % SPEED _____ RPM LOCKED ROTOR _____ AMPS. F.L. _____ AMPS.

TEMP. RISE _____ °C % OVERLOAD FOR _____ MINUTES

YEAR PURCHASED _____ PURCHASE ORDER _____

BEARINGS, CAT. NO. _____ SPECIAL FEATURES

STATOR COILS

NUMBER _____

SPEC. NO. _____

ROTOR SPEC. NO. of

COILS _____

BARS _____

(Rear)

SERVICE AND INSPECTION RECORD

| Date | Stator Megs | Stator Coils | Rotor Megs | Rotor Coils | Bearings | Coupling | Leads | Air Gap | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |

Items marked "S" were found in Satisfactory Condition
Items marked "R" were adjusted or repaired and made Satisfactory

Fig. 2-B

TRANSFORMER RECORD (Front)

LOCATION _____ MFR _____ TYPE _____ FORM _____

S/N _____ #A _____ #B _____ #C CKT VOLTS _____ KVA _____

AMPS _____ CYCLES _____ PHASE _____ REGULATION _____ %

TEMP. RISE _____ °C % OVERLOAD FOR _____ MINUTES

TOTAL OIL GALS. _____ TYPE OIL _____

YEAR PURCHASED _____ PURCHASE ORDER _____

H V BUSHINGS SPECIAL FEATURES

NUMBER _____

CAT. NO. _____

L V BUSHINGS

NUMBER _____

CAT. NO. _____

HV-LV _____ %R _____ %X _____ %Z _____ KVA

SERVICE AND INSPECTION RECORD (Rear)

| Date | HV Megs | LV Megs | OIL Dielec. | HV Bush. | LV Bush. | REMARKS |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |

Items marked "S" were found in Satisfactory Condition
Items marked "R" were adjusted or repaired and made Satisfactory

# RECIPROCATING-PUMP Q&A FOR POWER ENGINEERS

By E F WRIGHT

## II—Remedies for Direct-Acting Pump Troubles

*In the eleventh of a series, E F Wright, chief engineer, reciprocating pump division, Worthington, selects questions and answers that give practical understanding of construction, operation, characteristics, troubles and remedies.*

**Q 1—What are the common types of trouble?**

A—Operating, or hydraulic, and mechanical. Direct-acting steam pumps and power pumps have many troubles in common.

**Q 2—Why does a direct-acting steam pump sometimes fail to start?**

A—Low steam pressure is a common condition that prevents a duplex steam pump starting. Condensate in the cylinders or steam line seldom prevents the unit from starting slowly, although the line and cylinders should be drained of condensate. A simplex pump may stroke to one end, and then refuse to reverse. Often condensate causes this difficulty; it can be corrected by installing drain cocks on the steam chest covers. If a simplex pump has been standing idle for some time, heavy oil may prevent movement of the steam-thrown valve piston. Disassembly and cleaning is the best remedy for this condition, but steam pressure and heat usually loosen such a piston.

**Q 3 — What prevents delivery of liquid?**

A—A pump may fail to prime because of too high a suction lift, air leaks in the suction line, leaky pump valves, or worn liquid piston packing. When starting against a discharge head, the pump may be unable to discharge even a small amount of air from the cylinder or suction line. The unit thus fails to deliver until the air is released from the discharge side at low pressure. When changing over from hot to cold water, the liquid cylinder and its contents must be cooled if the suction head is to be lower when pumping cold water. A hot pump quickly changed to operate with a suction lift becomes steam-bound. Operation under this condition quickly damages liquid piston packing; see chart, page 120.

**Q 4—What causes a pump to deliver less than rated capacity?**

A—If a steam pump will not run at desired speed, low steam pressure, high backpressure and excessively tight packing are the usual causes. Steam-valve and piston-ring wear and leakage also limit pump capacity. If the unit runs at rated speed and fails to deliver full capacity, the cause may be worn and leaking piston packing and valves, and air leaking into the suction.

**Q 5—What makes a pump vibrate?**

A—Common causes are misalignment caused by faulty installation, distortion due to expansion of the pump or piping, or warping of the foundation. Tight packing, particularly on the liquid piston, causes uneven action and vibration at low speeds; see chart, page 120.

**Q 6—What causes rapid scoring and wear of piston rods and plungers?**

A—Misalignment of the pump, overly tight packing, or packing that has lost its lubricant and become hardened, or the wrong kind of packing for the service. Dirt and scale from the pipeline or dirt in the liquid being pumped also score rods and plungers. The same considerations apply to liquid cylinder liners and pistons.

**Q 7—How can the steam end of a pump be tested for abnormal leakage?**

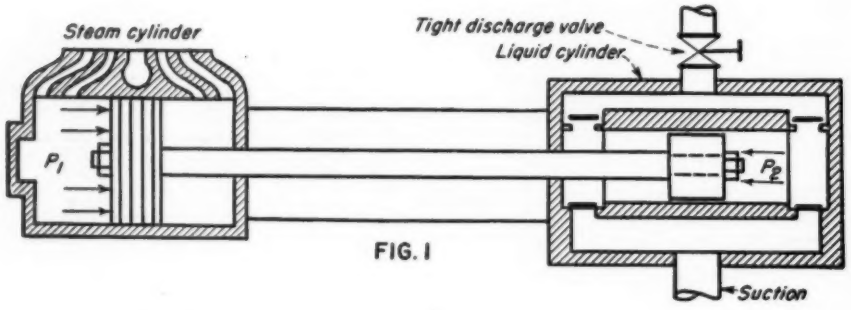



FIG. 1

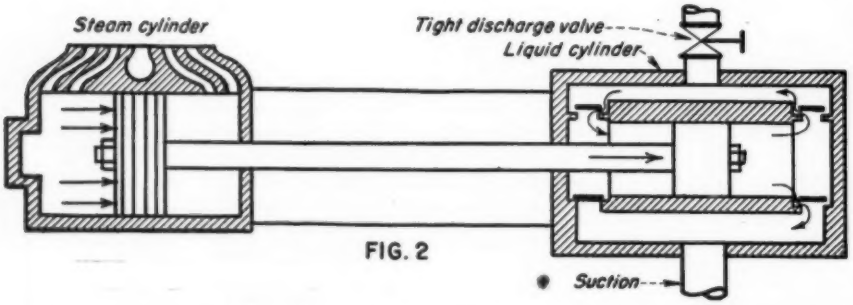



FIG. 2

**Fig. 1—If suction valves and discharge stop valve are tight and piston packing leaks freely, slip tests show pump can develop pressure to burst liquid cylinder. Fig. 2—Leaking suction valve on piston pressure side or leaking discharge valve on suction side permits piston movement on slip test, as shown**

# C-H 9586

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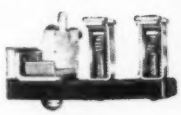

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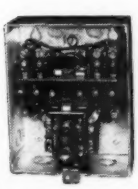

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Starter available with or without push-buttons in case, with transfer switch, in combination starter, as "skeleton."

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# PUMP Q&A

*Continued*

A—By operating the pump against load with the exhaust open to atmosphere. A tight pump exhausts relatively little steam during the stroke, but has a sharp and heavy exhaust at the moment of release when the steam valve passes center.

**Q 8—How can the liquid end of a steam pump be tested for leakage?**

A—By operating a fully primed pump at slow speed against a closed discharge valve. Throttle the steam supply to obtain no more than normal discharge pressure, and note the time for each stroke and for a complete revolution of the pump, which should be 25 to 50 times that at normal speed. This is termed a slip test; the time required is a good indication of liquid-end tightness.

**Q 9—What precautions must be observed in making a slip test?**

A—Carefully control the discharge pressure by throttling the steam supply, even if the discharge is protected by a

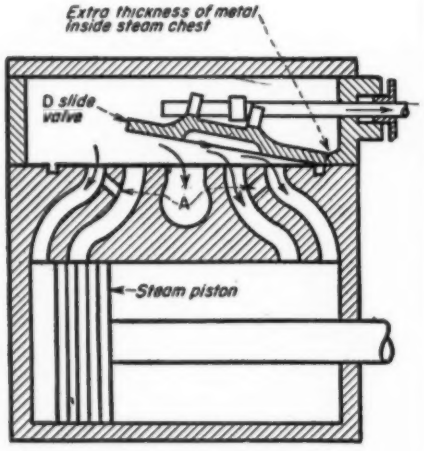


**Fig. 3—When a D slide valve was adjusted off center, it was lifted off its seat by being pulled against a lump of metal inside the steam chest**

relief valve. Particularly in a simplex pump, if suction valves and discharge stop valve are tight and liquid freely bypasses the liquid piston packing, the piston rod enters the cylinder like the plunger of a single-acting plunger pump, Fig. 1. Steam pressure, $P_1$, acting on the full steam piston, must be bal-

## CHECK CHART FOR CAUSES AND REMEDIES OF TROUBLES IN DIRECT-ACTING STEAM PUMPS

| SYMPTOM | CAUSE | REMEDY FOR TROUBLE |
|---|---|---|
| Pump fails to discharge | 1 *Not properly primed* | Reprime pump. Keep vents open on force chamber (above discharge valves) until pump is free of air. Use screw-down check valves for venting individual cylinders to prevent reentry of air on suction stroke. |
| | 2 *Suction lift too high.* | For cold water at sea level, suction lift should not exceed 22 ft. Check with vacuum gage. |
| | 3 *Air leaks in suction line.* | Blank off suction line and test with water pressure. Seal joints with suitable compounds. |
| | 4 *Air bound.* | Prime as under 1. Pump should have discharge check valve so air may be vented without compressing it to discharge pressure. |
| | 5 *Steambound.* | Not enough suction head for hot water. Provide at least 15 ft of static suction head for 212-F and hotter water. In changing from heated suction to cold suction from a lower level, pump must be cooled before it can pick up with a suction lift. |
| | 6 *Suction line strainer clogged.* | Examine strainer and inside of suction line to make sure they are free of all obstructions. |
| | 7 *Foot valve stuck.* | Clean valve and make sure it can open freely. Pipe may screw into valve far enough to hold it closed. |
| | 8 *Suction valves stuck.* | See that valves are free and working properly. |
| | 9 *Suction valves worn.* | Reseat valves. Renew valves and seats if necessary. |
| | 10 *Piston packing badly worn.* | Replace with properly fitted packing. If necessary replace or rebore liners. |
| | 11 *Rod packing worn.* | Repack rod stuffing boxes. |
| Pump not up to capacity: discharge pressure low | If pump speed is slow: | |
| | 1 *Low steam pressure.* | Under average conditions steam pumps have about 75% efficiency. That is, at rated speed, the ratio of discharge pressure to steam pressure will be about 75% of the ratio of piston areas. |
| | 2 *High back-pressure.* | The effective pressure is the steam pressure minus the back-pressure. Check backpressure in calculating performance under 1. |
| | 3 *Tight packing.* | Unduly tight piston or rod packing will limit speed of pump. |
| | 4 *Worn steam end.* | Excessive leakage of steam piston rings and steam valves will lower efficiency. Reface and renew as required. |
| | If pump speed is fast: | |
| | 5 *Worn piston packing.* | Repack liquid piston. Rebore or replace liner if necessary. |
| | 6 *Blocked or leaky valves.* | Remove any material blocking valves open. Reseat valves, or renew them and seats as required. |
| | 7 *Air leaks in suction.* | Check suction line for leaks. A high spot in a suction line will permit air to collect until it passes into pump all at once, air-binding one or more cylinders. Rearrange line to slope continuously up to pump suction. |
| | 8 *Excess air or gas in water.* | If water contains excess air or gas, which separates out at high suction lift, provide a tank near the pump suction with a float-controlled vacuum pump to remove air from top of tank as it separates from the water. |
| | 9 *Suction lift too high.* | For cold water do not exceed 22 ft with average pump. |
| | 10 *Foot valve or strainer partly clogged.* | Excessive friction and a high-suction gage reading shows when foot valves or strainers are partly clogged. Clean as required. |
| | 11 *Suction pipe not sufficiently submerged.* | Extend intake end of suction line far enough into suction well to prevent vortexes forming at the surface of the liquid through which air is drawn into the suction line. Deepen suction well if necessary. For an emergency condition, planks floating on the surface of the water usually prevent vortexes forming. |
| Short Stroking (continued) | 1 *Tight packing.* | Packing in steam and liquid ends of pump should be only tight enough to reduce leakage to a reasonable amount. Allow for swelling of packing, particularly in pistons, under service conditions. |
| | 2 *Excessive cushion in steam cylinders.* | If provided, adjust cushion valves to get rated stroke. If a pump consistently short strokes, and cushion valves are not provided, cushion release holes between steam and exhaust ports may be necessary. |
| | 3 *Steam-valve leakage.* | Leakage past the steam side of a pump valve provides live steam in end of cylinders, which stops the piston as soon as it cuts off the exhaust port. Replace valve and seat to stop leakage. |
| | 4 *Air or gas in liquid pumped.* | Excessive air or gas in liquid pumped will cause severe short stroking of a duplex pump. Correct suction conditions. |

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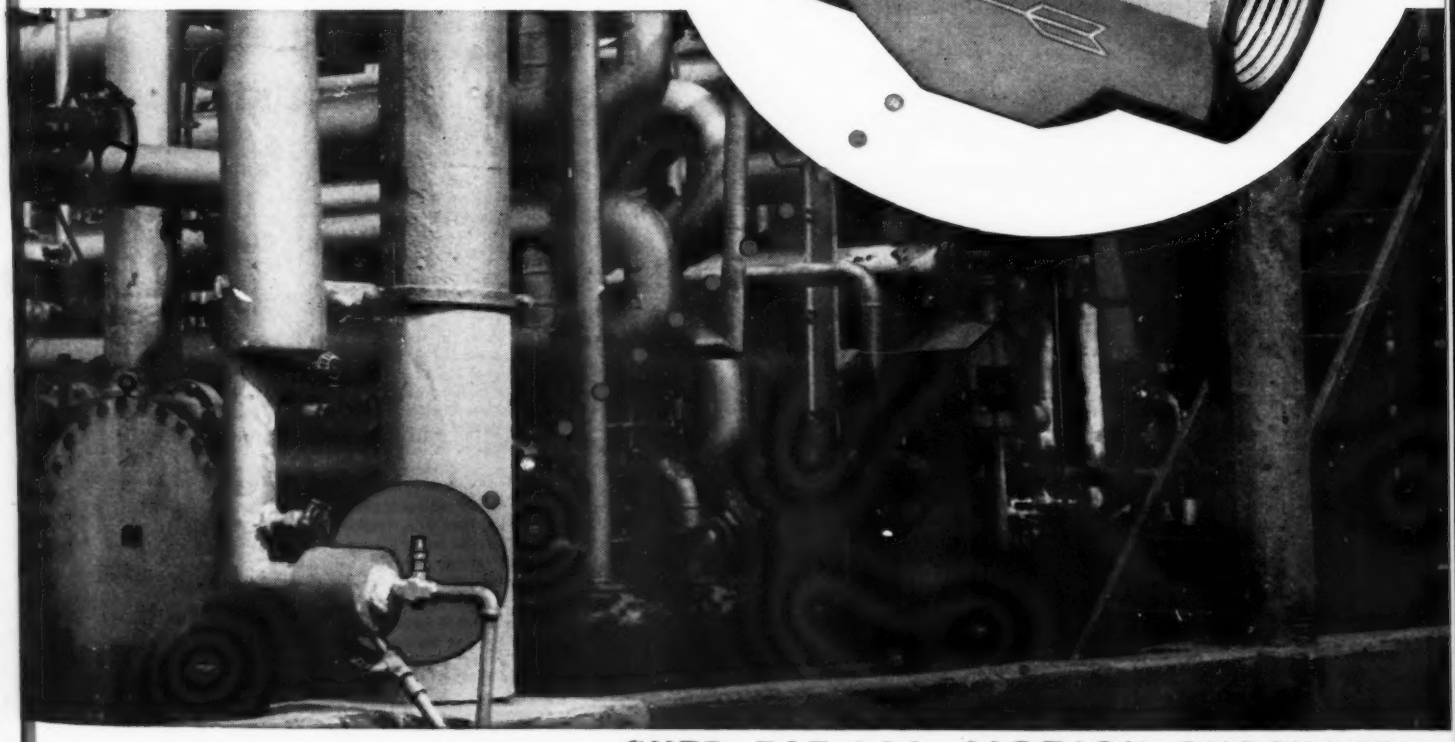

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## PUMP Q&A

*Continued*

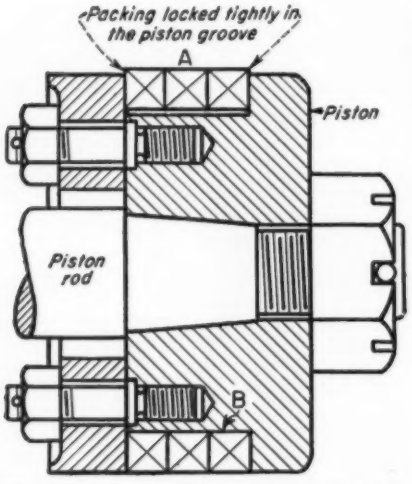


**Fig. 4—The swelling of the packing locked it in the piston groove causing abnormal friction in one case, and heavy leakage by piston in another**

anced by liquid pressure $P_2$, acting on the piston rod area only.

This action, termed "hydraulicing," may develop sufficient pressure to burst the liquid cylinder, if the piston packing is badly worn. On a demonstration I have seen a pump, which normally requires 200-psi steam to develop 300-psi liquid pressure, build up a liquid pressure of 750 psi on only 25-psi steam. This operation was on a new pump, before the liquid piston rings were seated against the cylinder liner; badly worn packing may cause even more severe pressure increase.

**Q 10—How can a slip test be used to distinguish between leaky valves and leaky piston packing?**

A—Leaky piston packing usually permits the piston to slip at nearly the same rate for both directions of motion. Two or more valves seldom leak at the same rate. Thus the rate of slip varies with the direction of motion: A high rate of slip in one direction may be caused by a leaking suction valve on the pressure side of the piston, allowing loss of water back to the suction with little or no delivery. A leaking discharge valve, on the suction side of the piston, may allow water from the discharge to nearly balance the pressure on both sides of the piston. Fig. 2 indicates the effects of these faults.

(*Continued on page* 146)

## CHECK CHART: DIRECT-ACTING PUMPS

| SYMPTOM | CAUSE | REMEDY FOR TROUBLE |
|---|---|---|
| Short Stroking (continued) | 5 *Piston rings striking shoulders worn in steam cylinder bore.* | Remove shoulders by reboring cylinder. Fit oversized pistons and rings to suit bore. If wear is not too great, shoulders may be removed with portable grinder. Adjust pump to full stroke to prevent wearing shoulders at end of stroke. |
| | 6 *Not enough lost motion.* | If adjusting nuts are provided, increase lost motion to lengthen stroke. This applies particularly to simplex pumps. If other remedies fail, reduce thickness of square nut in fixed lost motion duplex pumps. |
| | 7 *Valves set wrong.* | Set valves according to instructions supplied by pump manufacturer. |
| | 8 *Pumps not properly lubricated.* | A small but steady supply of lubrication to steam cylinder is essential to smooth and troublefree operation. |
| Long stroking, piston strikes head | 1 *Cushion valves not properly adjusted.* | Cushion valves should be closed enough to keep steam pistons from striking the cylinder head at maximum operating speed. Where pumps are run for fairly long periods at reduced speed cushion valves may be opened to prevent short stroking, and closed again before operating at increased speed. Adjust cushion valves under load to suit maximum conditions. |
| | 2 *Too much lost motion.* | Reduce lost motion to get rated stroke at maximum speed with cushion valves nearly closed. Too much lost motion in a duplex pump will make the pump sluggish and prevent any overlapping of the strokes of the two sides of the pump. |
| | 3 *Worn steam piston rings.* | Badly leaking steam piston rings make the cushion ineffective. Replace rings, reboring cylinder if necessary.[1] |
| | 4 *One piston strikes head, the other short strokes.* | This condition is most likely to develop in an outside-packed plunger pump, and is usually caused by excessive packing friction on one plunger. Loosen gland or remove one or more packing rings on the short-stroke side, as required to balance friction. Look for leaky valves in the liquid end on the side that over-strokes. |
| Vibration and pressure fluctuation | 1 *Pump out of line.* | Check foundation and hold-down bolts to be sure pump is not pulled out of shape when at operating temperature. Be sure that piping strains do not pull pump out of line. |
| | 2 *Packing too tight.* | Overly tight piston packing will cause chatter and vibration, particularly at low speeds. Allow for expansion of piston packing under service conditions. When unfamiliar with the packing used, check for swelling after it has been in service for a week or two. |
| Pressure fluctuates; jumps at start of the stroke | 1 *Air in liquid end of pump.* | If suction lift is high operate pump at slow speed with open vents until it is certain that all air is out of pump and suction line. |
| | 2 *Speed too high.* | If liquid is viscous, heat to reduce viscosity, and increase suction head to make sure pump fills. The service conditions as much as the pump's design determine the maximum operating speed. Extra long suction and discharge lines require reduced speed unless effective cushion chambers are kept properly charged. |
| | 3 *Not fully primed.* | See 1 in first section, "Pump fails to discharge," p 120 |
| | 4 *Not enough suction head for liquid temp.* | Reduce speed of pump, increase suction head or reduce temperature of liquid. See 5 in section, "Pump fails to discharge." |
| Pump stalls | 1 *Valves improperly set.* | Reset steam valves in accordance with manufacturer's instructions. |
| | 2 *Steam valves worn.* | A duplex steam pump may stall or hesitate just past midstroke because of steam leakage past the steam valve on the opposite side of the pump. At five-eighths' stroke the valve it actuates is at midposition where severe leakage robs the operating piston of its motive steam. Leakage of the pilot valve or valve-operating piston of a simplex pump causes it to stall at the end of its stroke. |
| Excessive stuffing-box leakage | 1 *Shoulder worn in cylinder at ends of stroke.* | When the steam pistons hit the shoulders, they lift the rod in the stuffing box, causing blowby at the ends of the stroke. Correct as under 5 in section, "Short stroking." Run pump at not less than rated stroke so that rings may over-ride the counterbore provided to prevent formation of such shoulders. |
| | 2 *Rods worn.* | Since a piston rod cannot run clear through the packing, it wears less at each end than in the middle. This causes leakage throughout the center part of the stroke. Replace worn rods, or restore to original diameter by building up with spraying and refinishing. |
| | 3 *Pump out of line.* | See 1 under section "Vibration and pressure fluctuation." |
| | 4 *Bent piston rod.* | Repair or replace piston rod. Piston rod must be true and smooth throughout the length that runs in the packing. |

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# MATH TIPS

**PHIL SWAIN GIVES HELPFUL HINTS TO EVERYDAY USERS OF NUMBERS AND HOMESPUN MATHEMATICS**

## Freehand Figuring Has Practical Value

▶ T-SQUARE and triangle are wonderful tools for their intended uses, yet we must admit it is without such mechanical aids that the greatest masterpieces of painting and drawing are achieved. They are done freehand.

Arithmetic, too, has its freehand masterpieces — approximate calculations made with incredible speed without any mechanical props—not even pencil and paper.

### SLAPDASH DEFENDED

As I explain the slapdash methods of freehand figuring they may shock readers accustomed only to the standard procedures of exact arithmetic as taught in school. Errors as high as ten percent in some cases will be hard for some to swallow.

In defense let me say that most of America's topnotch engineers and scientists make such high speed, rough mental calculations almost daily and with complete confidence in their practical value. Their skill in the method is matched by their judgment, which tells them just when a given degree of possible error in the answer is of no consequence.

The engineer who has this skill and this judgment will solve workaday problems faster, and be more successful in engineering and business conferences where quick answers often turn the tide.

### NUMBER JUGGLING

The main trick in freehand figuring is to round out the actual numbers involved into numbers easy to handle. At the same time, errors made in one direction can be partly compensated by deliberate errors in the other direction.

In this connection note, where two numbers are to be multiplied, that the answer will not be greatly changed if one number is increased by a certain small percentage, and the other is decreased by approximately the same percentage.

**Problem:** $48\times104 = ?$ Change both in opposite direction about 4%. Then $50\times100 = 5000$, so $48\times104 = 5000$, approximately.

**Problem:** $27\times225 = ?$ The approximate answer is $30\times200 = 6000$.

Here's a similar rule for division: The answer in division will not be greatly in error if both numbers are increased or both decreased by about the same percent. In this case, the percent of change need not be small.

**Problem:** $296 \div 39 = ?$ Approximately, $300 \div 40 = 30 \div 4 = 7.5$.

**Problem:** $935 \div 108 = ?$ Knock both down about 6 to 8%.

Then $860 \div 100 = 8.6$, approximate answer.

**Problem:** $146 \div 93 = ?$ Jack both up about 8%. Then $160 \div 100 = 1.6$, approximate answer.

### A SPECIAL CASE

If all the numbers involved are close to powers of 10, approximate multiplication and division can be reduced to simple addition and subtraction. This applies where all numbers involved are within 10%, say, of 1 or 10 or 100, or 0.1 or 0.01, etc.

No matter where the actual decimal point is, think of each number as 1, plus or minus .01, .02, .03, .04, .05, .06, .07, etc. To multiply a string of such numbers find the *net excess* over 1, or the *net deficit* below 1. The answer (except for decimal place) is merely 1 plus this net excess, or minus this net deficit. All this will be clear from examples:

**Problem:** $96.2\times103 = ?$ Shifting decimal points, $0.96\times1.03 = ?$ The 0.96 has a deficit of 0.04 and the 1.03 an excess of 0.03 leaving a net deficit of 0.01. Product is then 0.99. Correcting decimal place, we have $96.2\times103 = 9900$, approximately.

**Problem:** $0.0105\times103.000\times94\times.097 = ?$ Write it $1.05\times1.03\times0.94\times0.97 = ?$ The computation $5 + 3 - 6 - 3$ shows a net deficit of 1. So approximate product is 0.99, or 9900 corrected for decimal place.

Where one number is *divided* by another the same rule applies after reversing the sign of the excess or deficit in the divisor.

**Problem:** $106 \div 9.8 = ?$ Write it $1.06 \div 0.98 = ?$ The 1.06 has a surplus of 0.06. The deficit of 0.98 is 0.02. Reverse it to give a surplus of 0.02, and add this to 0.06 to give 0.08. Then the approximate answer is 1.08, or 10.8 corrected for decimal place.

**Problem:** $938 \div 1020 = ?$ Write it $0.94 \div 1.02 = ?$ The 0.94 has a deficit of 0.06. The 0.02 surplus of 1.02 reverses to a 0.02 deficit. The net deficit is .08. Therefore, $938 \div 1020 = 0.92$, approximately:

### OPPOSITE NUMBERS

Another useful trick is substituting an easy multiplication or division for a hard division or multiplication. Use the pairs of "opposite numbers" on the same lines of the two columns below.

| | |
|---|---|
| 2 | 5 |
| 4 | 25 |
| 8 | 125 |

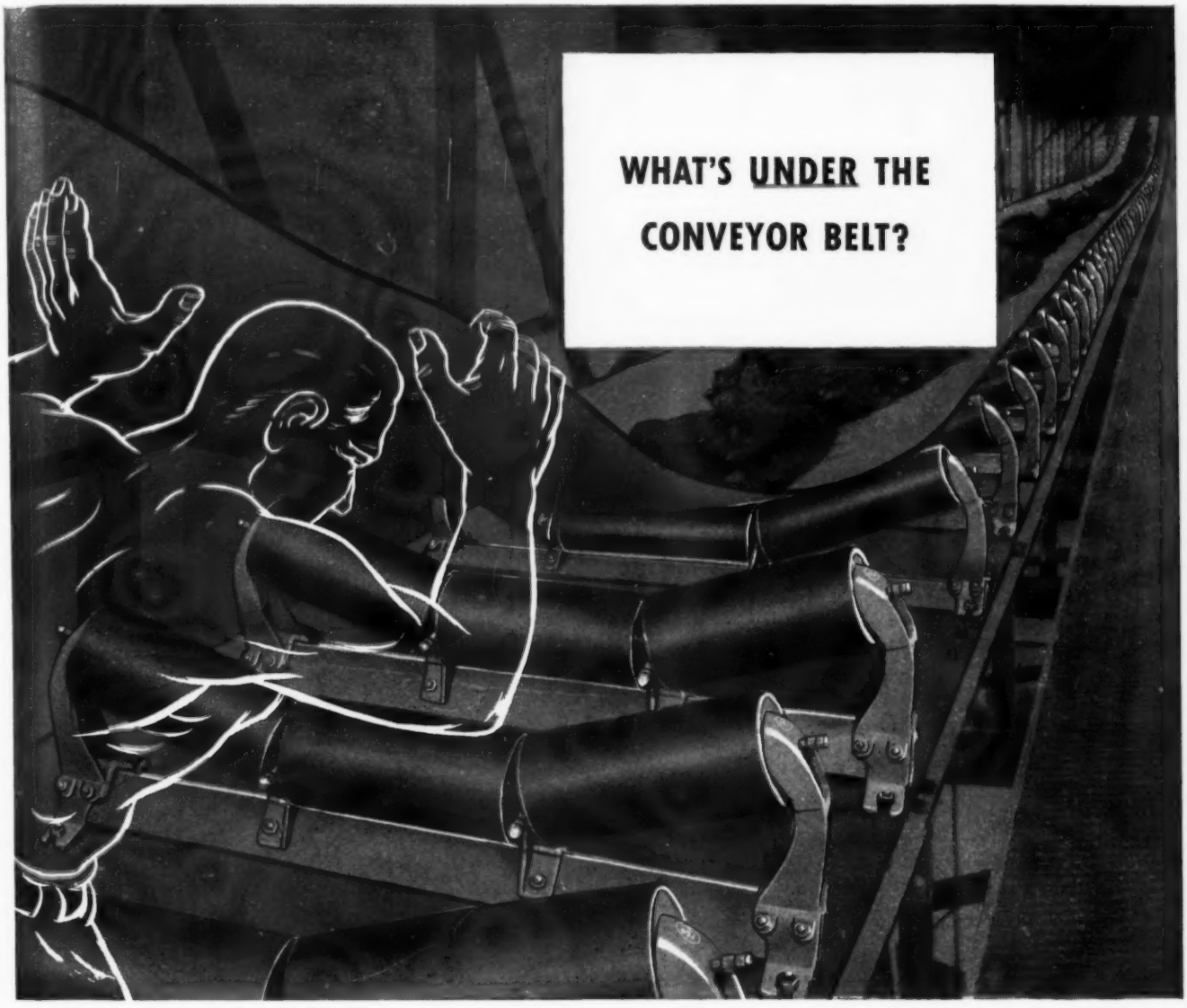
Neglecting decimal places, you can always substitute for multiplication or division, by any of these numbers, division or multiplication, respectively, by its opposite number. For example (neglecting decimal places), multiplying by 8 is the same as dividing by 125, and dividing by 4 is the same as multiplying by 25. This is a great timesaver.

**Problem:** $30 \div 12.5 = ?$ Neglecting decimal points, $30\times8 = 240$. Correct pointing is 2.4.

**Problem:** $160 \div 25 = ?$ Note that $4\times16$ is 64. So answer is 6.4.

**Problem:** $243\times125 = ?$ Change 243 to 240 to be divisible by 8. Note that $240 \div 8 = 30$, so $243\times125 = 30{,}000$, approximately.

Watch this page next month for applications of freehand figuring to everyday engineering problems.




## An all-important question in belt conveyor design

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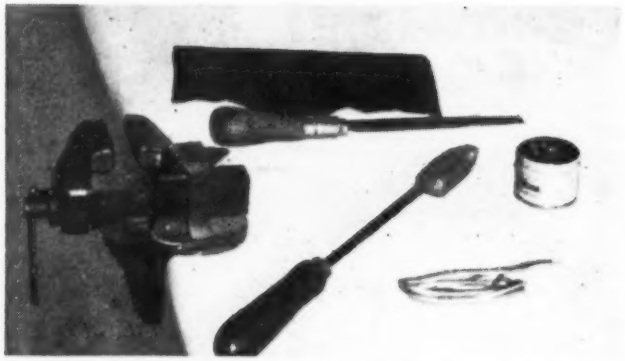
# HOW TO RECONDITION A SOLDERING COPPER

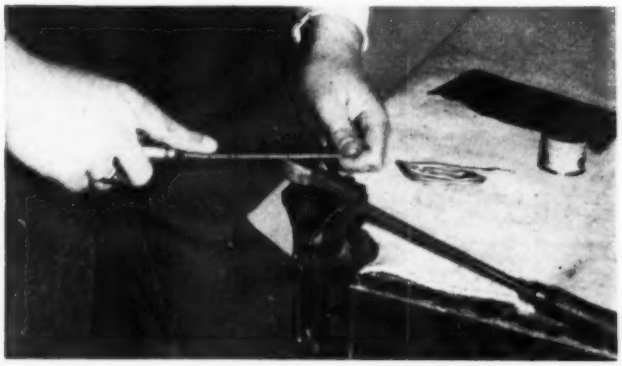


**1** In preparation for tinning a soldering copper assemble the necessary materials on the work bench within easy reach. Included are sandpaper or emery cloth, solder, flux, bench vise, file and blow torch, or other source of heat to bring the copper to the proper temperature.

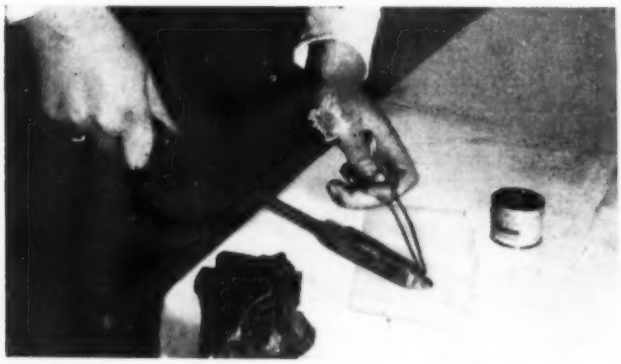
► HALF THE TRICK of a good soldering job is having the copper tip tinned thoroughly so that new solder wets the tip evenly and completely. When the copper is properly tinned a good-sized drop of solder can be picked up and deposited on the joint wherever needed.

On the other hand, a corroded or oxidized tip will not pick up solder regardless of how much flux is applied to the copper. And a tip unwet by solder will not flow the metal on a joint even when solder and copper are applied to the joint simultaneously. Reason is that melted solder must wet both the tip and joint to transfer heat from the copper to the part being soldered.

Corrosion of a soldering copper appears as pits in the surface. It comes from applying excessive amounts of flux to the tip beyond the tinned area. Overheating burns away the tinning and accelerates oxidation of the tip. In either case the pits and discoloration should be removed down to a clean surface, and the soldering copper conditioned according to the procedure outlined in the photographs on this page if you expect a workmanlike job.



**2** Corroded tips eventually reach the point where they must be resurfaced to increase the tinned area. Do this by filing each face to a true plane surface until the pits are removed or reduced to inconsequential size. Remove oxidation with sandpaper or with emery cloth.



**3** After dressing each face to a good surface the tip is ready for tinning. Heat copper until it makes a lively hissing sound when touched to the flux. Spoon out small amount of flux with solder; apply both to tip while rubbing one face lightly on sandpaper to make solder adhere.

**4** Tin one face, then another until tip has uniform coat of tin over each face. In rubbing the tip on sandpaper move it around to new areas so the glue on the paper is not melted. Caution: With plated electric-soldering coppers use a hard cloth instead of a file and sandpaper.

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The makers of Steam-Chef take no chances with haphazard on-the-site venting arrangements. Each Steam-Chef is equipped at the factory with designed-to-order Webster Special Vent Traps—one for each steam chamber. By turning to Webster, Cleveland Range utilizes to the fullest the 60 years of specialized experience in steam circulation of the pioneer organization in vacuum steam heating and the country's largest thermostatic trap manufacturer.

If you manufacture heating apparatus using steam, check with Webster to see if their experience can help you to better the performance of your product. Or, if you use steam heating apparatus lacking adequate venting means, look into the possibilities of an installation modernization program to better the performance of your present equipment.

For a copy of Webster's Process Steam Trap engineering data bulletin, address Dept. P-7.

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**HEATING SYSTEMS**

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# WATER-TREATMENT QUESTION BOX

## IS OLD-TIME FEED TREATMENT OKAY?

By K M Herstein and John S G Shotwell

►THIS THIRTEENTH DISCUSSION in a series on boiler- and process-water treatment explains why old-timers put potatoes or kerosene in their boilers, claiming they would prevent scale or corrosion. These letters came from the files of Karl Herstein, of Herstein Laboratories, and John Shotwell, chemical engineer. (Next month a new author.)

Goodwater Laboratory
Drum City, U.S.A.

Dear Chemist:

Some old-timers used kerosene while others put potatoes in their boilers. These practices are said to be harmless, and they were claimed to prevent scale or corrosion. Do they have this ability? If not, why were they used?

Yours truly,
Walter Tender

Dear Walter:

The practice that some old-timers adopted of putting kerosene or a bucket of Irish potatoes in their boilers did help to reduce the formation of hard scale in many cases, but it did not prevent corrosion.

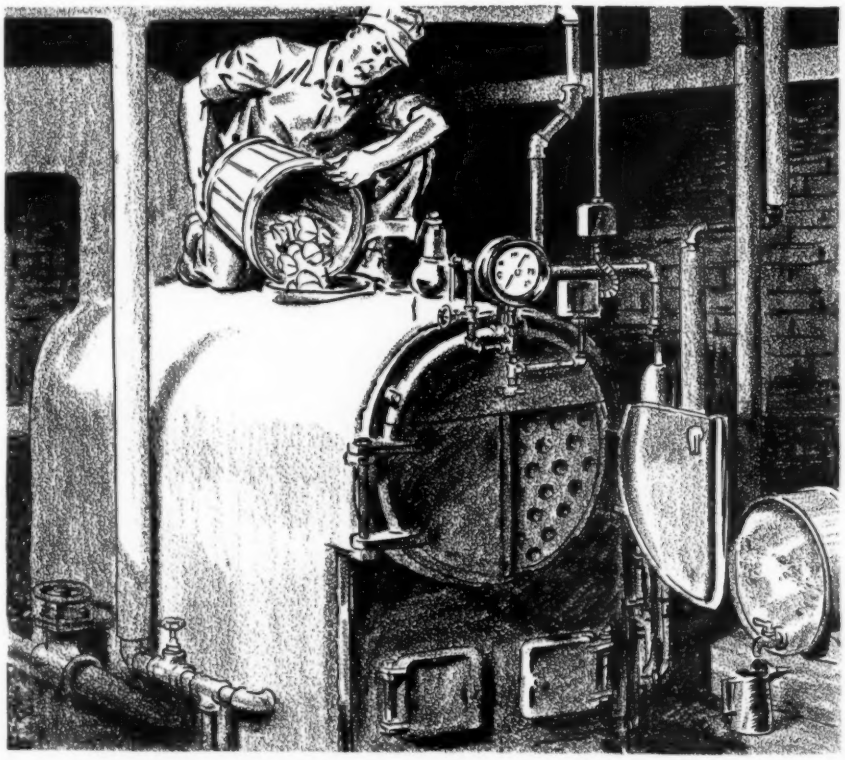
Irish potatoes and kerosene do not soften water, nor do they prevent the deposit of scale-forming materials. What they do, however, is to form a protective film around each particle that prevents these minute parts sticking to each other and forming cakes, and then sticking to the boiler surfaces. Thus, these scale formers fall to the bottom as harmless sludge, easily disposed of, instead of producing hard difficult-to-remove scale.

Used in this way, kerosene might be likened to grease that keeps meat from sticking to a frying pan. Potatoes act somewhat like cornstarch used in salt and sugar to keep them from caking in a saltcellar or bowl, or like flour dusted on the outside of cake or bread dough to keep it from sticking to a pan. Potatoes and kerosene give reasonable satisfaction if the water is not too hard and if boiler pressure is fairly low.

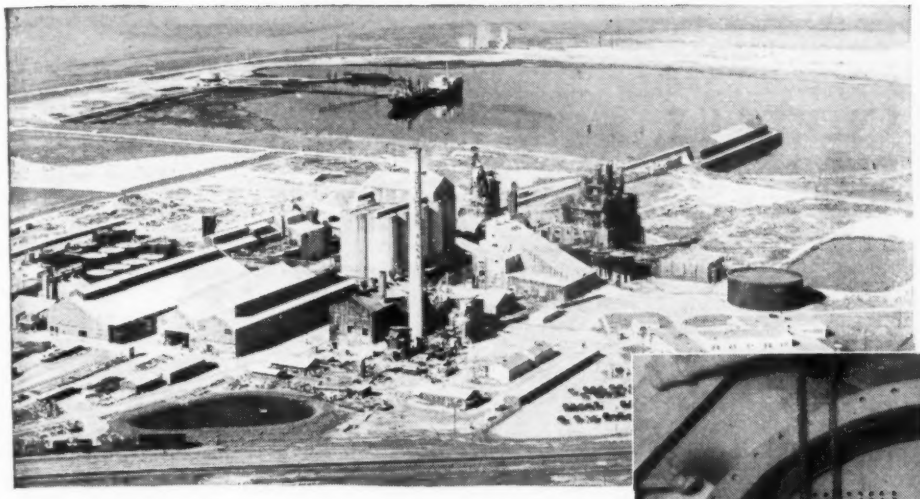
The modern practice of adding colloidal materials to boiler feedwater insures that floc coagulates in such a way that it forms a harmless sludge and does not stick to itself or to the boiler surfaces and form scale. Petroleum byproducts and starch are two common colloidal materials used for this purpose. While kerosene is a petroleum product and potatoes are a rich source of starch, they are not the best for this purpose although they are moderately effective. There are other petroleum products that are more easily emulsified and form better protective colloids than kerosene. Potatoes are rich in starch but they also contain certain other materials, some of which are not desirable in a boiler.

The use of such materials as kersosene and potatoes, not specially designed for feedwater treatment, is not recommended as a general procedure. There are times, however, when the ideal materials are unavailable and one must use whatever is at hand. It is for this reason that the operator, who has an understanding of what is behind modern feedwater treatment, is able to improvise when faced with an emergency.

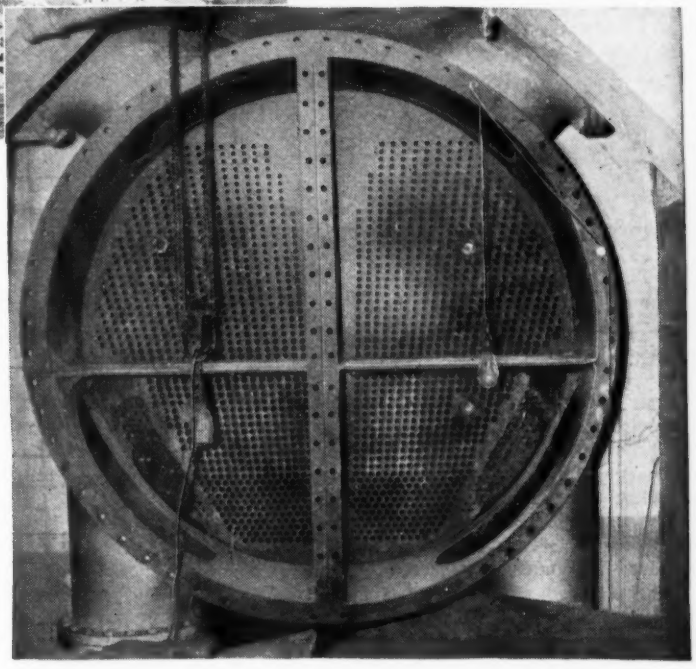
Yours truly,
Chemist
Goodwater Laboratory



Faced with an emergency, the operator who understands what is behind modern feedwater practice is able to improvise treatment from whatever is available



● *Highly corrosive salt water from the Corpus Christi ship channel is the cooling medium for this condenser at the Southern Alkali Corporation plant, Corpus Christi, Texas. Anaconda Super-Nickel was selected for this retubing job because of its superior resistance to corrosion by salt water.*



# *Retubing* with Anaconda *SUPER-NICKEL* Condenser Tubes

## to combat salt water corrosion

THIS CONDENSER at the Southern Alkali Corporation plant at Corpus Christi, Texas, is being retubed with 1,910 Anaconda Super-Nickel Condenser Tubes 1″ O.D. x .065″ wall x 18′ 2⅝″ long. The pressure of the salt water coolant in this condenser is 10 to 15 pounds, giving a velocity of from 4 to 6 feet per second.

Super-Nickel tubes were chosen in this instance because of the outstanding performance of this 70-30 alloy in service at sea, as well as ashore, under highly corrosive conditions.

The American Brass Company produces tubes and plates for condenser and heat exchanger applications from a wide range of standard and special copper alloys. Anaconda Rolled Plates are unsurpassed for soundness and close-grained structure.

Ask our Technical Department for assistance in selecting the most suitable alloys for any heat exchange requirement. For further information on Anaconda Condenser Tubes and Plates, write for Publication B-2. 47132

ANACONDA
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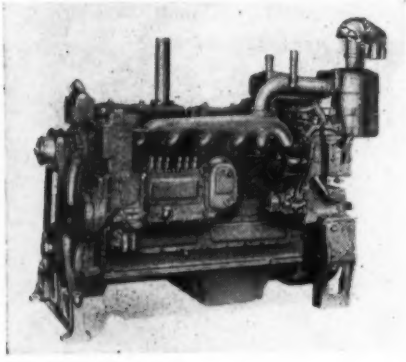
**THE AMERICAN BRASS COMPANY**
General Offices: Waterbury 88, Connecticut
*Subsidiary of Anaconda Copper Mining Company*
*In Canada:* ANACONDA AMERICAN BRASS LTD.
*New Toronto, Ont.*

# WHAT'S New IN PLANT EQUIPMENT



## Diesel Engines

WITH ONE-THIRD GREATER OUTPUT than the models they replace, new Caterpillar *D*315 and *D*318 diesel engines embody many refinements in design. These include: heavier, stronger crankshaft with 36% larger journals and 30% larger crank-pin bearings, individual inlet and outlet manifolds positioned on opposite sides of cylinder head, larger valves and high lifts, oil-cooled strut-type pistons with aluminum-alloy body and head and cast-iron band for top ring groove, porous-chrome plated top ring, new oil-pressure control system, improved injection-valve design, solid aluminum-alloy main and connecting rod bearings, a newly designed governor and provisions for more effective cooling of lubricating oil and water.

Replacing the *D*4400 engine, the 4-cyl *D*315 has a maximum output, with radiator cooling and full equipment, of 70 hp; the comparable rating for the 6-cyl *D*318 (*shown*) which replaces the *D*4600, is 105 hp. Both engines are available as industrial units, electric sets and marine engines. **Dept P, Caterpillar Tractor Co, Peoria, Ill.**

## Multispeed Transmission

GEAR TRANSMISSION can shift in any one of four forward speed positions in one second, adapted to pushbutton control. It may be shifted under any condition of speed or load without temporary lag or loss of speed and power. Transmission shifts easily and automatically synchronizes gears before each shift.

Wright transmission has helical or spiral groove cut in main shaft, which is center of the mechanism. Action of shift lever moves selector gears forward or backward along this spiral until they synchronize with the desired gear. In this way there is a constant torque applied to drive shaft and all shifting is done in a straightforward or reverse motion. It is available for ground or marine transport or stationary power plants requiring quick changes in speed. **Dept P, Curtiss-Wright Corp, 30 Rockefeller Plaza, New York**

## Mercury Switch

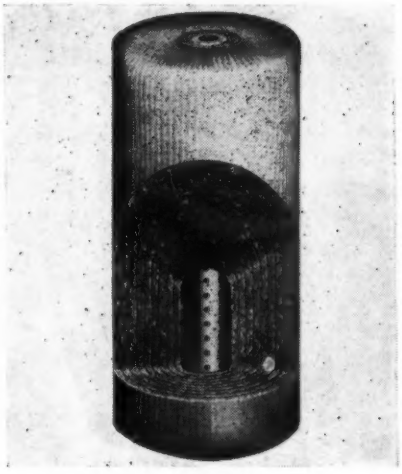
LESS THAN 1½ in. long, this switch is rated at 1 amp for 115-v ac. It handles almost any switching job. Simple in design, dependable, and economical in cost, it saves space in switch action mechanism. Switch is actuated by a snap tilt of 12 deg and has single-pole single-throw action. **Dept P, Minneapolis-Honeywell Regulator Co, Minneapolis, Minn.**

## Insulation Tester

RECTIFIER-OPERATED megger insulation tester (diagram below) can be plugged into 115-v ac circuit instead of hand cranked. This tester is useful where many tests are made at one time or where individual tests run for several minutes. This instrument is essentially a modification of the company's meg-type insulation tester. It has a power pack consisting of a stepup transformer and selenium rectifier, to give a constant dc voltage, which replaces hand generator. The tester's ohmmeter covers a wide range and is independent of applied voltage. Ratings range up to 2000 megohms at 1000 v. **Dept P, James G Biddle Co, 1316 Arch St, Philadelphia 7, Pa.**

## Liquid-Level Gage

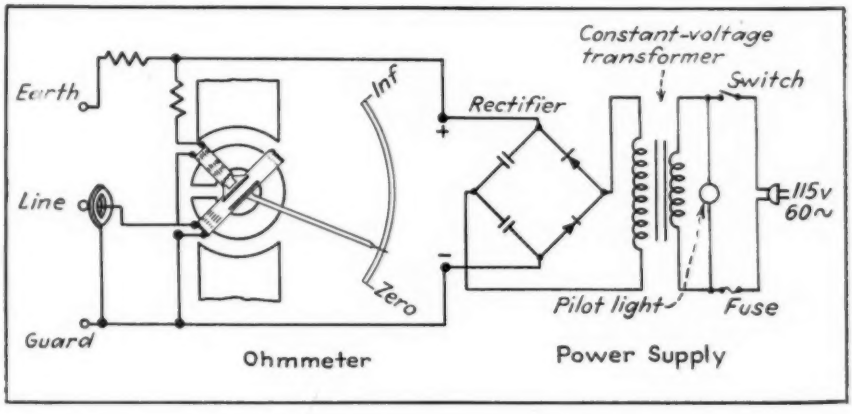
NEW S TANK-O-METER measures tank contents at any remote point, regardless of whether tanks are open, vented, under pressure or under vacuum. Gages can be furnished with high- or low-alarm switches for closing or opening a circuit at any predetermined high or low level. Fifty-two standard models are available for measuring liquid depths one to 75 ft. Gage can be furnished for hand pump or compressed air operation. **Dept P, Uehling Instrument Co, 473 Getty, Paterson, N. J.**



## Replacement Oil Filter

ENGINE-LIFE REPLACEMENT FILTER consists of lint-free textiles wrapped in a closely knit muslin and pressure wound around a perforated metal core. Entire unit is then covered with a heavy tubing or muslin jacket. Horizontal flow of oil from outside to inside through laminated construction materially increases dirt and sludge removal. As elements absorb contaminants they expand, thus allowing greater dirt storage capacity and higher saturation.

Engine Life filter will not rob oils of their additives and may serve with any oil, regardless of its service or application. Replacement elements are available in 260

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# All piping equipment . . . All pre-fabrication . . . on One Order to CRANE

**ONE**
**SOURCE OF SUPPLY**
**RESPONSIBILITY**
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Pipe fabrication of every sort is Crane Co.'s business. From a simple bend to the most complex welded assembly, your design is assured of precise fabrication. Fully equipped, skillfully manned and strategically located, five Crane Pipe Shops are at your service.

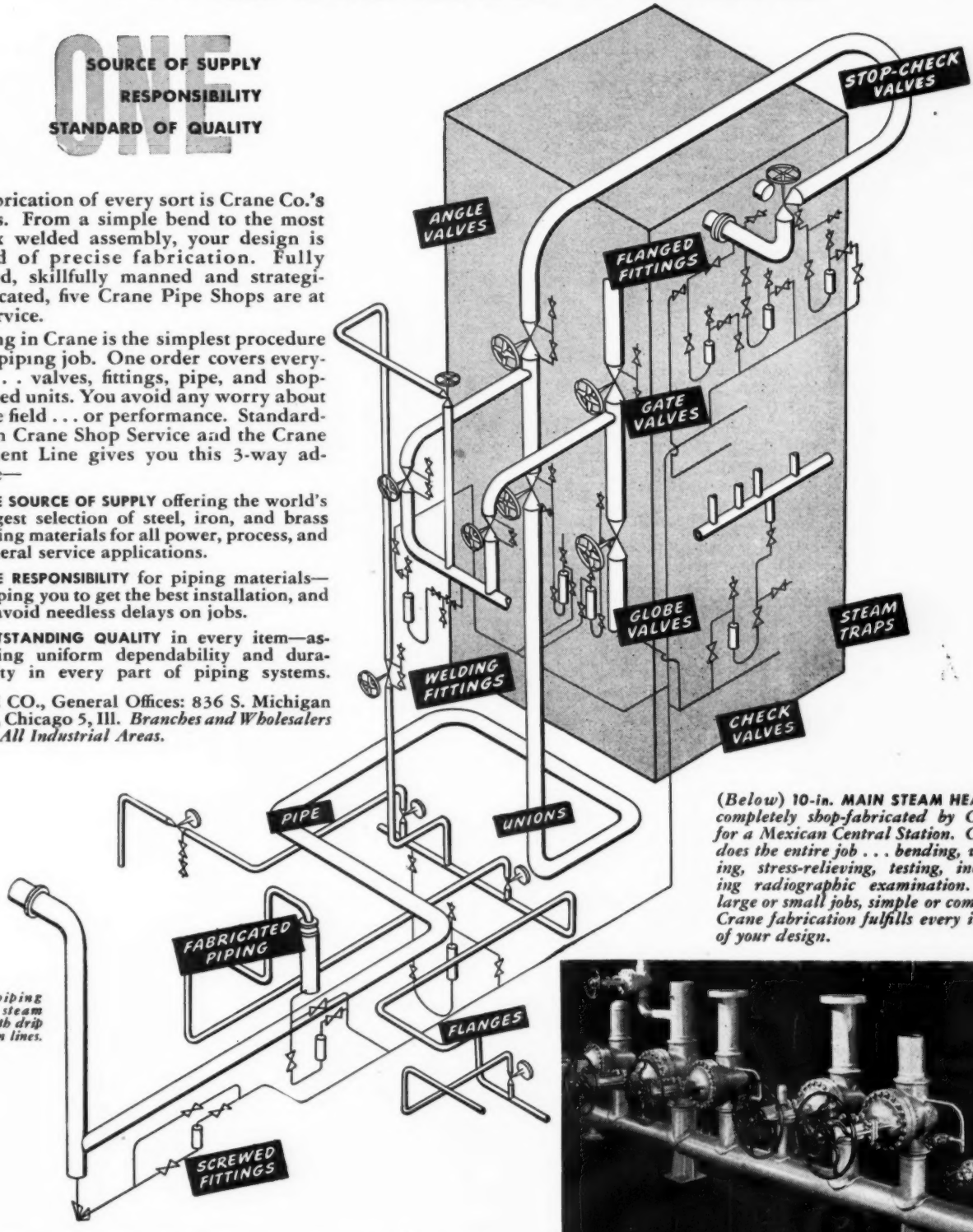
Calling in Crane is the simplest procedure on any piping job. One order covers everything . . . valves, fittings, pipe, and shop-fabricated units. You avoid any worry about fit in the field . . . or performance. Standardizing on Crane Shop Service and the Crane Equipment Line gives you this 3-way advantage—

**ONE SOURCE OF SUPPLY** offering the world's largest selection of steel, iron, and brass piping materials for all power, process, and general service applications.

**ONE RESPONSIBILITY** for piping materials—helping you to get the best installation, and to avoid needless delays on jobs.

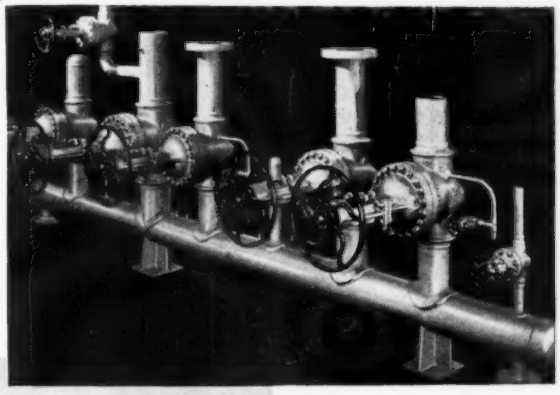
**OUTSTANDING QUALITY** in every item—assuring uniform dependability and durability in every part of piping systems.

CRANE CO., General Offices: 836 S. Michigan Avenue, Chicago 5, Ill. *Branches and Wholesalers Serving All Industrial Areas.*




*Boiler piping showing steam mains with drip and drain lines.*

(*Below*) **10-in. MAIN STEAM HEADER** *completely shop-fabricated by Crane for a Mexican Central Station. Crane does the entire job . . . bending, welding, stress-relieving, testing, including radiographic examination. On large or small jobs, simple or complex, Crane fabrication fulfills every intent of your design.*



**EVERYTHING FROM . . .**

**VALVES • FITTINGS**
**PIPE • PLUMBING**
**AND HEATING**

# CRANE

**FOR EVERY PIPING SYSTEM**

## Equipment *Continued*

different sizes to fit all popular makes of filter cases. No adapters, springs, spacers or liners are necessary to make them fit.

These filters are extensively used in the automotive field, diesel electric plants, industrial applications for power plants, in shops for coolants and lubricating oils, oil fields and pipeline equipment, for maintaining construction and mining equipment, for marine engines and pumps, farm power equipment, and for many other applications where dirt, grime and moisture in oil result in engine breakdown. **Dept P, Engine-Life Products Corp, El Monte, Calif.**

## Air Compressor

UNITAIR COMPRESSORS are available in nine sizes with power requirements from 15 to 100 hp and piston displacements from 81 to 590 cfm at 100 psi discharge pressure, based on 60-cycle motor speed. Compressors are completely air cooled. Drives include gasoline or diesel engines, built-in motor, direct-connected motor and V-belt. Forced-feed lubrication is supplied by a gear-driven pump. Valves are low lift with large port area. Piston has four rings. **Dept P, Sullivan div, Joy Mfg Co, Oliver Bldg, Pittsburgh 22, Pa.**

## Water Test Kit

COMPACT METAL CABINET contains the apparatus and standardized chemicals needed to make accurate chloride determinations on marine and stationary high-pressure boilers. The cabinet, with an acid-resistant finish, can be easily carried by its folding handle, or hung at any required location from slotted holes in back. The cover, when opened, provides a rigid working shelf, which also contains full operating instructions. Over-all weight is about 7 lb. **Dept P, TruTest Laboratories, Inc, 20 S 33rd St, Philadelphia 4, Pa.**

## Ac Welding Control

AVAILABLE IN TWO FRAME SIZES, the 1200 and 600, *Weld-O-Timer* can be side mounted on welder, or floor mounted in a nearby location. Adjustment controls are at the welder for either kind of installation. A convenient fingertip control speeds production as each individual job is quickly set. Voltage regulator tubes are in timing circuit to give more accurate timing when connected to welder supply circuit.

Inspection of these subassemblies is simplified in both models by a front access door. In the 1200 frame size a swing-out feature provides access to rear panel. Access to the 600 frame size is by tilting subunit panels forward.

Maintenance is reduced by ready accessibility to all parts of factory assembled subunits and simplified circuits that need fewer parts. A transparent door in the 1200 frame size and a metal door in the 600 size protects control settings against unauthorized tampering. **Dept P, Westinghouse Electric Corp, Box 868, Pittsburgh 30, Pa.**

## Signaling Timer

SERIES S SIGNALING TIMER commands visual and audible attention the instant a time interval is completed. It provides automatic closing or opening of a circuit at end of elapsed time. It also operates additional buzzers, bells or lights at remote locations.

When pointer on timer is manually set to required interval, indicated on dial, a pilot light indicates that the time interval has started. Moving pointer revolves counter-clockwise toward zero, and at any instant during the interval exact time elapsed is shown on dial. When the interval is completed an audible alarm sounds and pilot light goes out. The alarm continues to sound until toggle switch is snapped off or timing interval restarted.

Two sockets, red and black, are on side of case for both normally open or normally closed circuit control or additional lights or alarms. Resetting of pointer knob to same time interval is by adjustable backstop.

*Series S* timers are inclosed in a metallic gray case readily attachable to any wall or panel or standard switchbox. Unit operates on ac, 115 or 230 v, at 25, 50 or 60 cycles. **Dept P, Industrial Timer Corp, 110 Edison Pl, Newark 5, N. J.**

## Unloading Pump

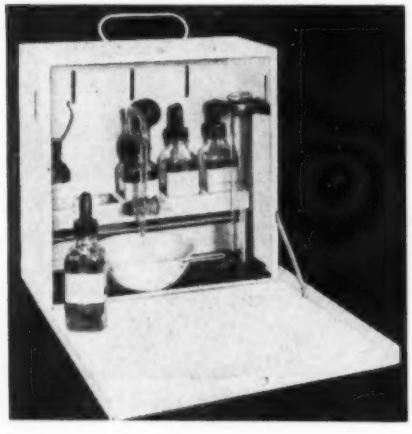
HYDRAULIC-SYSTEM GEAR PUMP does not need unloading valve or accumulator. It is essentially two pumps in a single casing. A pilot valve, an integral part of the pump, controls an opening in channel from outlet port to rear of movable bearings in pump cover. When specified pressure has been reached in hydraulic system, pilot valve closes passage to rear of bearing to eliminate pressure loading. Pressure in gear teeth then forces cover bearings away from gears and larger section of pump stops delivery with a decrease in power input.

A small section of the pump continues to deliver pressure fluid to keep hydraulic system alive. Excess fluid from pump's small section is returned to reservoir through relief valve. When selector valve is operated, system pressure drops to cause pilot valve to open channel to restore pressure loading in the larger section of the pump. Pump then delivers full capacity as long as required. **Dept P, Pesco Products Div, Borg-Warner Corp, 310 S Michigan Ave, Chicago 4, Ill.**

## Automatic Voltage Regulators

ORIGINAL LINE of *Stabiline* regulators, known as the *Seco* automatic voltage regulators, has been completely re-engineered to incorporate new electronic and mechanical developments. Most notable is the control circuit refinements that dictate operation of power elements to provide a constant voltage from fluctuating ac power lines. This unit offers faster detection of line voltage variation, non-microphonic performance, ease of installation and servicing, elimination of damage from shock, compactness and reliability.

(*Continued on page* 134)



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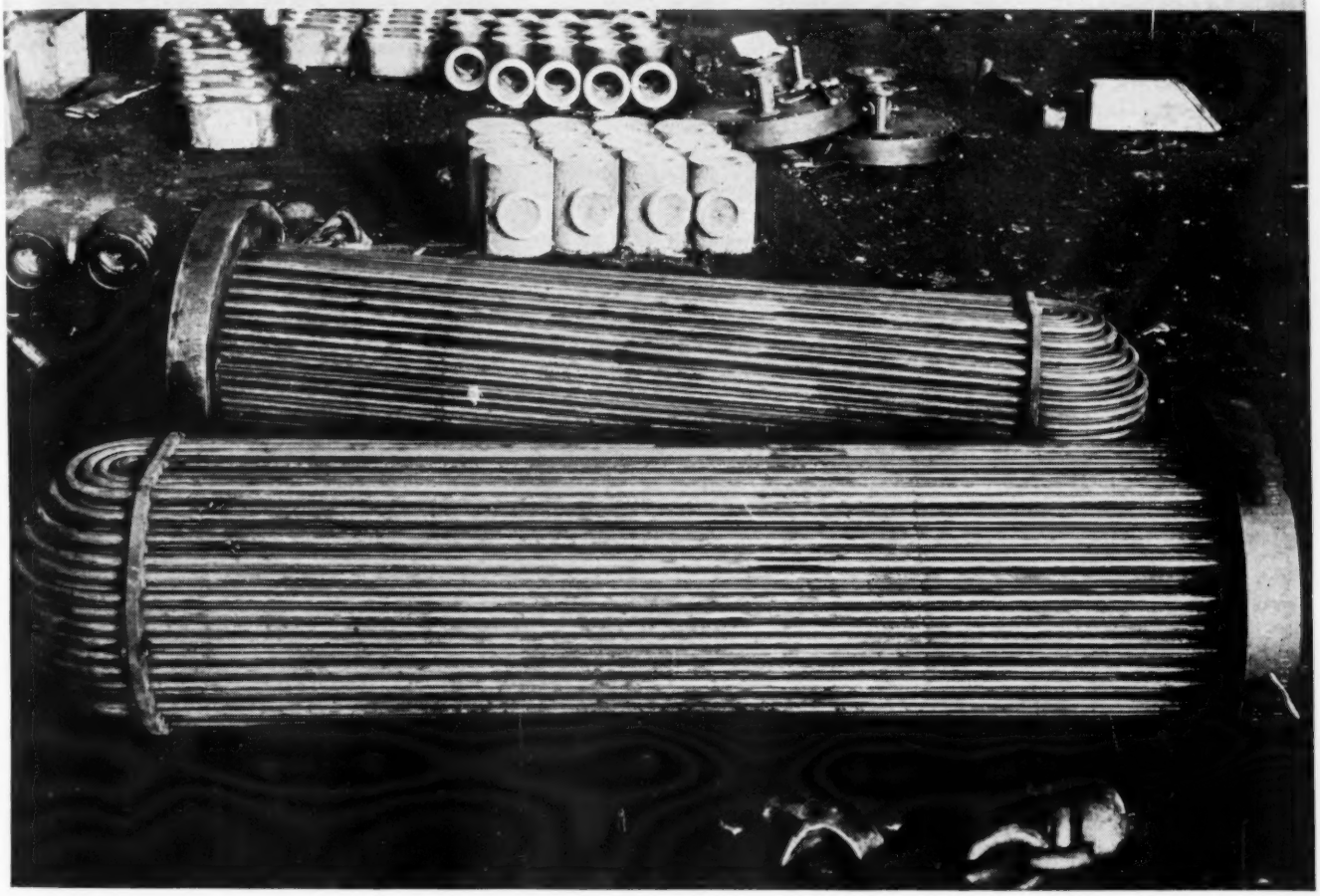
# WATCH OUT FOR CHANGED CONDITIONS



SOMETIMES a condenser will give years of service, only to fail quickly after re-tubing with tubes of exactly the same composition. When this occurs it need not be a mystery; very likely operating conditions have changed over the years.

Take the case of a condenser using brackish water as a coolant. In 13 years of service less than 100 tubes failed per year, out of 7,400 tubes. Then the rate of loss rose rapidly. Re-tubing with Admiralty tubes, which had been used in the original installation, did not check the rate of loss, which continued to be unacceptably high. Laboratory studies of failed tubes showed crescent-shaped grooves in the tube walls. These were the result of a severe local impingement type of erosion-corrosion, due to disturbed flow around small particles (scale or debris) which had attached themselves to the walls. Older tubes showed the same effect, but not so markedly or destructively. The conclusion was that the load on the condenser had been raised, increasing the effects of turbulence, debris, and air entrainment.

With 1-inch O. D. tubes, turbulent or eddy flow starts above 2½ feet per second; a spot check showed that water velocity was 6½ feet per second. Here was complete confirmation of the laboratory report. The recommendation: substitute 2% aluminum brass tubes, since this alloy forms a highly protective erosion-resistant film in brackish waters much more readily than Admiralty Metal.

If the velocity of the coolant is around 6 foot per second, you can anticipate severe erosion problems. Under such conditions, Revere Revalon (aluminum brass) tubes are indicated.

**REVERE**

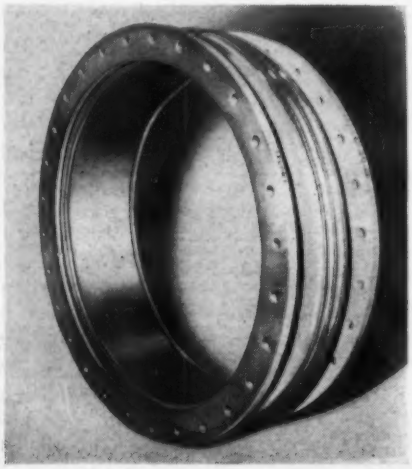
**COPPER AND BRASS INCORPORATED**

*Founded by Paul Revere in 1801*

230 Park Avenue, New York 17, New York

*Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere.*

All removable components, such as new voltage sensitive element and new unbreakable fast-acting relays, are plugged-in type. An exchange arrangement permits complete assembly to be unplugged from power element and replaced by another unit. Advantages of the old regulator are retained in new unit. Outstanding among these are: (1) Unit is not affected by changes in power factor or magnitude of load. (2) It has zero waveform distortion. (3) It does not affect power factor of the system. (4) High efficiency is maintained. (5) Unit has adjustable output voltage. **Dept P, Superior Electric Co, 1025 Church St, Bristol, Conn.**



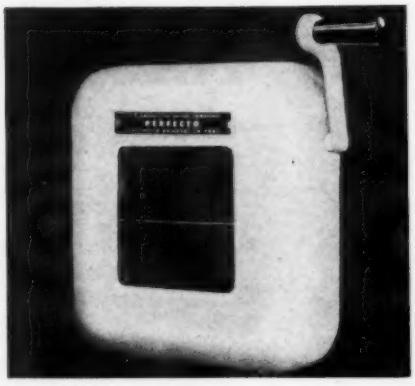
## Expansion Joints

LOW-PRESSURE LARGE-DIAMETER packless expansion joints range in sizes from 14 in. to 6 ft in dia. This latest addition to line is normally supplied in *Type* 347 stainless-steel to accommodate pressures up to 30 psi. Other metals may be specified.

Photo shows a 36-in. unit with three bellows flanges for a 3-in. total movement. For greater travel requirements, additional flanges may be added. **MagniLastic div, Cook Electric Co, Chicago 14, Ill.**

## Fume-Resistant Enamel

FUMEX, A FUME-RESISTANT ENAMEL, is used to paint interior walls and ceilings subject to acid, alkali or sulphide fumes. It can be applied on brick, concrete, plaster, wood and metal. Prime virgin or badly yellowed surfaces are treated first with *Fumex Undercoater*. Supplied in white only, it works easily under the brush. Use turpentine thinners for spray application. *Fumex* is washable and does not chip or flake when properly applied. **Dept P, A C Horn Co, 43-36 10th St, Long Island City 1, N. Y.**



## Observation Port

AIR-COOLED, ribbed shutter-equipped furnace observation door is made of three castings: (1) sleeve (2) shutter (3) cover. A 5¼x5¼-in. opening receives the sleeve casting held by anchor bolts set into furnace wall. Shutter casting follows. An externally operated handle permits opening this shutter without opening observation door. The cover casting with openings top and bottom for air cooling has a blue pyrex-glass window to diffuse glare, protect the observer's eyes. **Dept P, A P Green Firebrick Co, Mexico, Mo.**

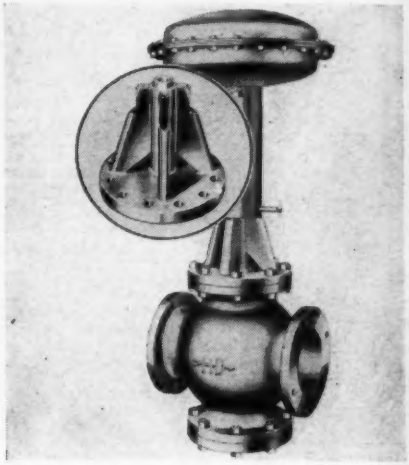
## Illuminated Meters

SIMPSON ILLUMINATED METER does away with translucent dials, but still floods every fraction of the dial face with an even radiance, according to maker, thus eliminating shadow spots. An ingeniously shaped *Lucite* cone carries light from a recessed bulb in instrument back through front edge of cone that entirely surrounds dial face. This makes possible use of the standard metal dial. Thus, tendency of the translucent dials to fade, discolor or buckle from age and heat is completely eliminated. Pointers cannot stick or readings be distorted by this method. Illuminated meters are available in 2- and 3-in. sizes in rectangular and round cases. **Dept P, Simpson Electric Co, Chicago.**

## Electronic Servo Mechanism

MOTRON SERVEL MODEL 61A is a package control system that can be applied to automatic control or regulation of a large variety of systems to eliminate human supervision. Several miniature vacuum tubes directly control (without circuit-breaking contactor) speed and direction of a standard 1/15-hp induction motor that can control other larger power sources. An input-dial controls either velocity or position of motor to accurate limits. Alternately, motor may act as a torque amplifier or remote positioning agent. Since the motor velocity (not torque) is controlled, load change or complete loss of load cannot cause instability.

This *Servo* is designed for short-time, constant system and is usually capable of great sensitivity, 15/100 of 1% to 3/100 of 1%. Electronic components are in a replaceable plug-in compartment for instant servicing. **Dept P, W C Robinette Co, 802 Fair Oaks, S Pasadena, Calif.**



## Valve Bonnet

VERTICAL U-TYPE FIN radiation bonnets are available for complete line of diaphragm-control valves in sizes 2 in. and larger. With valve installed in a vertical position, the U-section permits a natural-draft or chimney effect that cools packing box section of valve. With a common temperature of 1000 F on body side of bonnet, the vertical fins reduce temperature to 235 F at packing box. **Dept P, Hammel-Dahl Co, 243 Richmond St, Providence 3, R. I.**

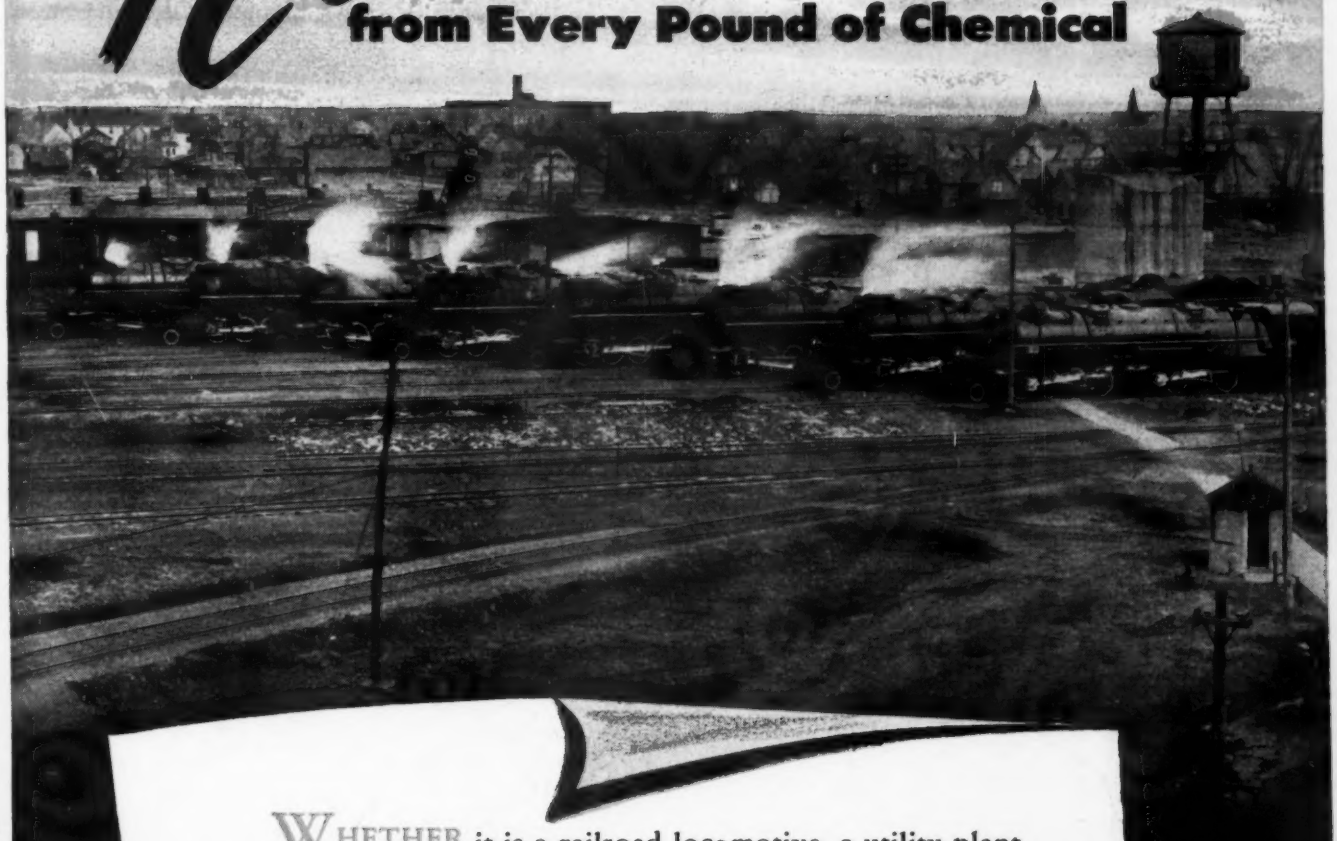
## Water Demineralizer

FILT-R-STIL DEMINERALIZER transforms ordinary tap water into chemical equivalent of distilled water. *Model U-60* requires no heat, steam or auxiliary equipment and uses only enough electricity to light a 6-watt bulb. Operating at a 60-gph flow rate, it delivers water containing a maxi-

(*Continued on page* 144)

**POWER** brings this monthly survey of new equipment as one of its many reader services. In requesting additional information from manufacturers, please identify the source of your inquiry by referring to Dept. P

# Maximum Water Treating *Results* from Every Pound of Chemical



WHETHER it is a railroad locomotive, a utility plant or a small heating boiler . . . the Nalco System will produce maximum water treating results from every pound of chemical.

The basic Nalco policy automatically requires the services of field representatives who are not merely salesmen but are water treatment *experts.* It also demands the finest laboratory facilities and personnel . . . Plus the best in mechanical equipment and chemicals.

When you shift to Nalco, you are assured of the service that goes with Nalco, chemicals to produce a *permanent answer to your water treatment problems.* Write today for further information.

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**6222 W. 66th Place, Chicago 38, Illinois**
*Canadian inquiries should be addressed to*
*Aluminate Chemicals, Ltd.. 555 Eastern Ave., Toronto 8, Ontario*

*Nalco* — the Scientific System of Water Treatment for All Industry.

# How to plan SOOT BLOWER CONNECTIONS ON A 250 POUND STEAM BOILER

**Another in the series of basic Piping Layouts prepared by Jenkins Bros.**

**High boiler efficiency** necessitates periodic removal of soot deposits from the boiler tubes through the use of soot blowers.

**Soot blowing** may be accomplished either with compressed air or steam, and this diagram shows a typical soot blowing installation in conjunction with a 250 pound boiler using superheated steam. Each soot blower head is provided with its own pressure reducing orifice since the pressure required depends on the location of the element, and different locations require different pressures.

**Steam for the soot blowers** is taken from a nozzle on the superheater. A vertical header from this point delivers steam to the various soot blower heads. The individual branches are all pitched down to the header to assure complete draining of the system prior to blowing.

**Each branch feeder** is provided with an emergency shutoff valve designed to take full boiler pressure. Should repair of a soot blower be necessary, the emergency valve can be shut, the remainder of the system still functioning. The main header and the short vertical riser are both provided with drains used to remove any condensate before any soot blowers are opened.

## Jenkins PRACTICAL PIPING LAYOUTS

**Illustrating the proved 3-point formula for trouble-free, time-defying hookups**

**A** Use the right type valve for the service.
**B** Place valves correctly in the line.
**C** Choose Jenkins Valves for lifetime economy.

**24**

**Fig. 990**
Bronze
Regrind-Renew
Angle Valve
300 lbs. Steam
600 lbs. O.W.G.

**Other types and pressure ranges** of Jenkins Valves can be used for this type of layout according to the factors involved. Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

Copies of Layout No. 24 will be furnished on request . . . also future Piping Layouts. Mail coupon.

**Fig. 990,** the Jenkins Bronze Regrind-Renew Angle Valve shown in this layout is chosen because of its great resistance to wear and abuse. All valves are 300 lb. bronze, to withstand pressure and temperature. The use of outside screw and yoke valves with rising spindles is recommended so that the operator may tell at a glance whether the lines to the soot blower heads are open or closed.

**A CHOICE OF OVER 600 JENKINS VALVES**

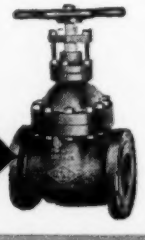
To save time, to simplify planning, to get the advantage of Jenkins specialized valve engineering experience . . . select all valves from the Jenkins Catalog. It's your best assurance of the *lowest cost in the long run.*

Jenkins Bros., 80 White Street, New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago; San Francisco. Jenkins Bros., Ltd., Montreal.

# JENKINS VALVES

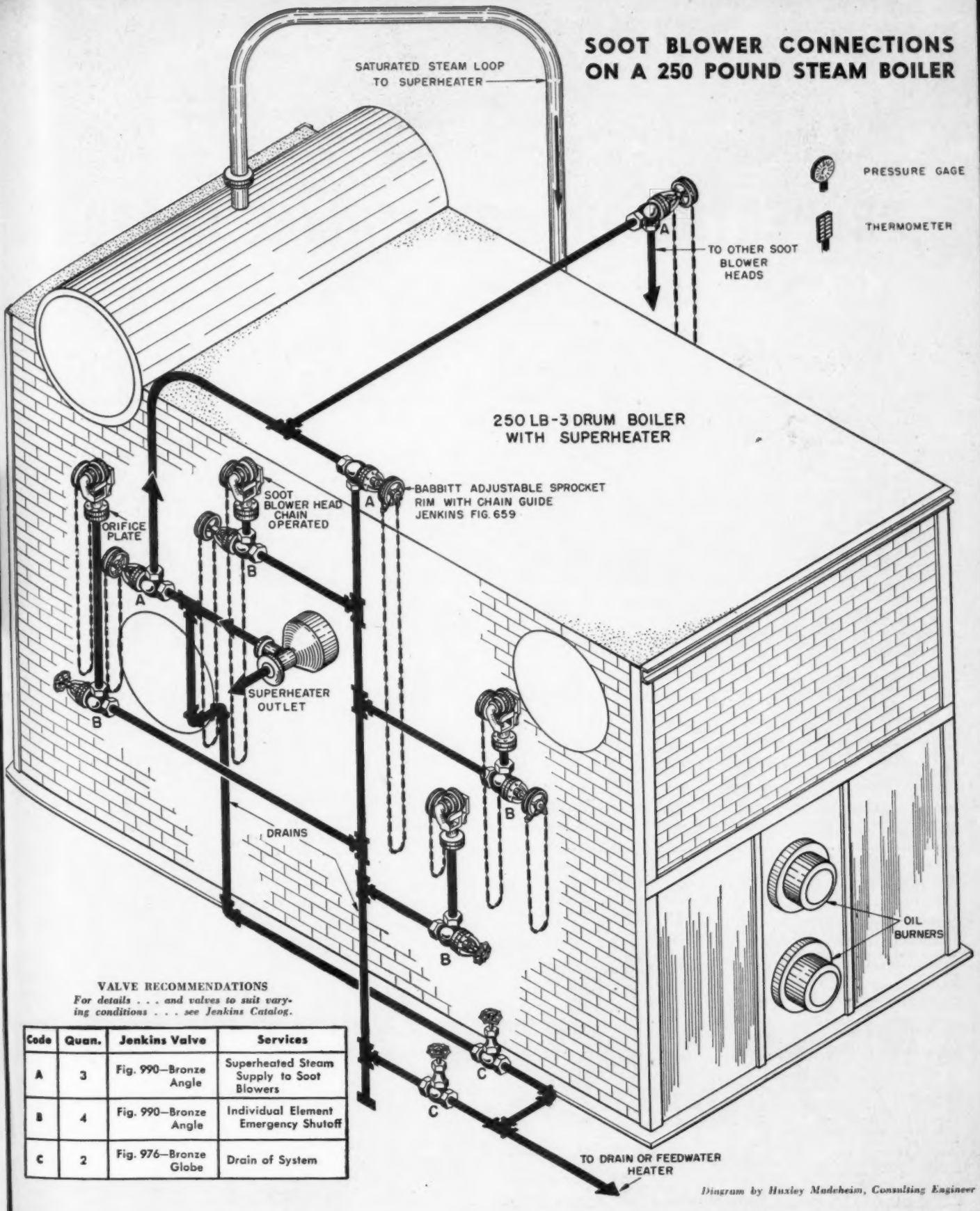
**LOOK FOR THE DIAMOND MARK**
SINCE 1864

TRADE JENKINS MARK
Jenkins Bros



**125 TO 600 LBS. STEAM PRESSURE**

# SOOT BLOWER CONNECTIONS ON A 250 POUND STEAM BOILER




VALVE RECOMMENDATIONS

*For details . . . and valves to suit varying conditions . . . see Jenkins Catalog.*

| Code | Quan. | Jenkins Valve | Services |
|---|---|---|---|
| A | 3 | Fig. 990—Bronze Angle | Superheated Steam Supply to Soot Blowers |
| B | 4 | Fig. 990—Bronze Angle | Individual Element Emergency Shutoff |
| C | 2 | Fig. 976—Bronze Globe | Drain of System |

*Diagram by Huxley Madeheim, Consulting Engineer*


# BRONZE • IRON • STEEL

FOR EVERY INDUSTRIAL, ENGINEERING, MARINE, PLUMBING-HEATING SERVICE

SOLD THROUGH RELIABLE INDUSTRIAL DISTRIBUTORS EVERYWHERE

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POWER'S DATA SHEETS

No. 179

# PROPERTIES OF COMMERCIAL GASES

For efficient use of fuel gases their combustion characteristics must be known. Here are the data on 26 commercial gases that are available in various regions of the United States. With this information it will be possible to check the operation of gas-fired furnaces to determine how close ideal conditions are being approached and to figure means of correcting wrong settings.

| Gas | Gas constituents, percent by volume | | | | | | | | | Specific Gravity |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Illuminants | | |
| | $CO_2$ | $O_2$ | $N_2$ | CO | $H_2$ | $CH_4$ | $C_2H_6$ | $C_3H_6$ | $C_4H_8$ | |
| Natural gas (Birmingham) | — | — | 5.0 | — | — | 90.0 | 5.0 | — | — | 0.60 |
| Natural gas (Pittsburgh) | — | — | 0.8 | — | — | 83.4 | 15.8 | — | — | 0.61 |
| Natural gas (S. California) | 0.7 | — | 0.5 | — | — | 84.0 | 14.8 | — | — | 0.64 |
| Natural gas (Los Angeles) | 6.5 | — | — | — | — | 77.5 | 16.0 | — | — | 0.70 |
| Natural gas (Kansas City) | 0.8 | — | 8.4 | — | — | 84.1 | 6.7 | — | — | 0.63 |
| Reformed natural gas | 1.4 | 0.2 | 2.9 | 0.7 | 46.6 | 37.1 | — | 1.3 | ($C_3H_6$ 0.8) | 0.41 |
| Mixed, natural and water gas | 4.4 | 2.1 | 4.7 | 25.5 | 35.1 | 23.1 | 4.7 | 0.2 | 0.2 | 0.61 |
| Coke oven gas | 2.2 | 0.8 | 8.1 | 6.3 | 46.5 | 32.1 | — | 3.5 | 0.5 | 0.44 |
| Coal gas (continuous verticals) | 3.0 | 0.2 | 4.4 | 10.9 | 54.5 | 24.2 | — | 1.5 | 1.3 | 0.42 |
| Coal gas (inclined retorts) | 1.7 | 0.8 | 8.1 | 7.3 | 49.5 | 29.2 | — | 0.4 | 3.0 | 0.47 |
| Coal gas (intermittent verticals) | 1.7 | 0.5 | 8.2 | 6.9 | 49.7 | 29.9 | — | 3.0 | 0.1 | 0.41 |
| Coal gas (horizontal retorts) | 2.4 | 0.75 | 11.35 | 7.35 | 47.95 | 27.15 | — | 1.32 | 1.73 | 0.47 |
| Mixed coke oven and carburetted water gas | 3.4 | 0.3 | 12.0 | 17.4 | 36.8 | 24.9 | — | 3.7 | 1.5 | 0.58 |
| Mixed coal, coke oven and carburetted water gas | 1.8 | 1.6 | 13.6 | 9.0 | 42.6 | 28.0 | — | 2.4 | 1.0 | 0.50 |
| Carburetted water gas | 3.0 | 0.5 | 2.9 | 34.0 | 40.5 | 10.2 | — | 6.1 | 2.8 | 0.63 |
| Carburetted water gas | 4.3 | 0.7 | 6.5 | 32.0 | 34.0 | 15.5 | — | 4.7 | 2.3 | 0.67 |
| Carburetted water gas (low gravity) | 2.8 | 1.0 | 5.1 | 21.0 | 47.5 | 15.0 | — | 5.2 | 2.4 | 0.54 |
| Water gas (coke) | 5.4 | 0.7 | 8.3 | 37.0 | 47.3 | 1.3 | — | — | — | 0.57 |
| Water gas (bituminous) | 5.5 | 0.9 | 27.6 | 28.2 | 32.5 | 4.6 | — | 0.4 | 0.3 | 0.70 |
| Oil gas (Pacific Coast) | 4.7 | 0.3 | 3.6 | 12.7 | 48.6 | 26.3 | — | 2.7 | 1.1 | 0.47 |
| Producer gas (buckwheat anthracite) | 8.0 | 0.1 | 50.0 | 23.2 | 17.7 | 1.0 | — | — | — | 0.86 |
| Producer gas (bituminous) | 4.5 | 0.6 | 50.9 | 27.0 | 14.0 | 3.0 | — | — | — | 0.86 |
| Producer gas (0.6 lb. steam per lb coke) | 6.4 | — | 52.8 | 27.1 | 13.3 | 0.4 | — | — | — | 0.88 |
| Blast furnace gas | 11.5 | — | 60.0 | 27.5 | 1.0 | — | — | — | — | 1.02 |
| Commercial butane | | ($C_4H_{10}$ 93.0) | | — | ($C_3H_8$ 7.0) | | — | — | — | 1.95 |
| Commercial propane | | ($C_3H_8$ 100.0) | | — | — | — | — | — | — | 1.52 |

| Gas | Cu ft air for comb per cu ft of gas | Btu per cu ft, gross | Btu per cu ft, net | Products of combustion, cu ft per cu ft of gas | | | | Ultimate $CO_2$ % | Btu net per c f of prod of comb | Flame temp, no excess air, F |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $H_2O$ | $CO_2$ | $N_2$ | Total | | | |
| Natural gas (Birmingham) | 9.41 | 1002 | 904 | 2.02 | 1.00 | 7.48 | 10.50 | 11.8 | 86.0 | 3565 |
| Natural gas (Pittsburgh) | 10.58 | 1129 | 1021 | 2.22 | 1.15 | 8.37 | 11.73 | 12.1 | 87.0 | 3562 |
| Natural gas (So. California) | 10.47 | 1116 | 1009 | 2.20 | 1.14 | 8.28 | 11.62 | 12.1 | 87.0 | 3550 |
| Natural gas (Los Angeles) | 10.05 | 1073 | 971 | 2.10 | 1.16 | 7.94 | 11.20 | 12.7 | 86.7 | 3550 |
| Natural gas (Kansas City) | 9.13 | 974 | 879 | 1.95 | 0.98 | 7.30 | 10.23 | 11.9 | 86.0 | 3535 |
| Reformed natural gas | 5.22 | 599 | 536 | 1.30 | 0.53 | 4.16 | 5.99 | 11.3 | 89.6 | 3615 |
| Mixed, natural and water gas | 4.43 | 525 | 477 | 1.01 | 0.64 | 3.55 | 5.20 | 15.3 | 91.7 | 3630 |
| Coke oven gas | 4.99 | 574 | 514 | 1.25 | 0.51 | 4.02 | 5.78 | 11.2 | 87.0 | 3610 |
| Coal gas (continuous verticals) | 4.53 | 532 | 477 | 1.15 | 0.49 | 3.62 | 5.26 | 11.9 | 90.7 | 3645 |
| Coal gas (inclined retorts) | 5.23 | 599 | 540 | 1.23 | 0.57 | 4.21 | 6.01 | 11.9 | 89.9 | 3660 |
| Coal gas (intermittent verticals) | 4.64 | 540 | 482 | 1.21 | 0.45 | 3.75 | 5.41 | 10.7 | 89.0 | 3610 |
| Coal gas (horizontal retorts) | 4.68 | 542 | 486 | 1.15 | 0.50 | 3.81 | 5.46 | 11.6 | 89.0 | 3600 |
| Mixed coke oven and carburetted water gas | 4.71 | 545 | 495 | 1.04 | 0.62 | 3.85 | 5.51 | 13.9 | 90.0 | 3630 |
| Mixed coal, coke oven and carburetted water gas | 4.52 | 528 | 475 | 1.11 | 0.50 | 3.71 | 5.32 | 11.8 | 89.3 | 3640 |
| Carburetted water gas | 4.60 | 550 | 508 | 0.87 | 0.76 | 3.66 | 5.29 | 17.2 | 96.2 | 3725 |
| Carburetted water gas | 4.51 | 534 | 493 | 0.75 | 0.86 | 3.63 | 5.24 | 17.1 | 94.2 | 3700 |
| Carburetted water gas (low gravity) | 4.61 | 549 | 501 | 0.98 | 0.64 | 3.70 | 5.31 | 14.7 | 94.3 | 3690 |
| Water gas (coke) | 2.10 | 287 | 262 | 0.53 | 0.44 | 1.74 | 2.71 | 20.1 | 96.6 | 3670 |
| Water gas (bituminous) | 2.01 | 261 | 239 | 0.47 | 0.41 | 1.86 | 2.74 | 18.0 | 87.2 | 3510 |
| Oil gas (Pacific Coast) | 4.73 | 551 | 496 | 1.15 | 0.56 | 3.77 | 5.48 | 12.9 | 90.5 | 3630 |
| Producer gas (buckwheat anthracite) | 1.06 | 143 | 133 | 0.22 | 0.32 | 1.34 | 1.88 | 19.4 | 70.5 | 3040 |
| Producer gas (bituminous) | 1.23 | 163 | 153 | 0.23 | 0.35 | 1.48 | 2.05 | 18.9 | 74.6 | 3175 |
| Producer gas (0.6 lb steam per lb coke) | 1.00 | 135 | 128 | 0.17 | 0.34 | 1.32 | 1.82 | 20.5 | 70.3 | 3010 |
| Blast furnace gas | 0.68 | 92 | 92 | 0.20 | 0.39 | 1.14 | 1.54 | 25.5 | 59.5 | 2650 |
| Commercial butane | 30.47 | 3225 | 2977 | 4.93 | 3.93 | 24.07 | 32.93 | 14.0 | 90.5 | 3640 |
| Commercial propane | 23.82 | 2572 | 2371 | 4.17 | 3.00 | 18.82 | 25.99 | 13.7 | 91.2 | 3660 |

*Courtesy, Industrial Division, Bryant Heater Co.*

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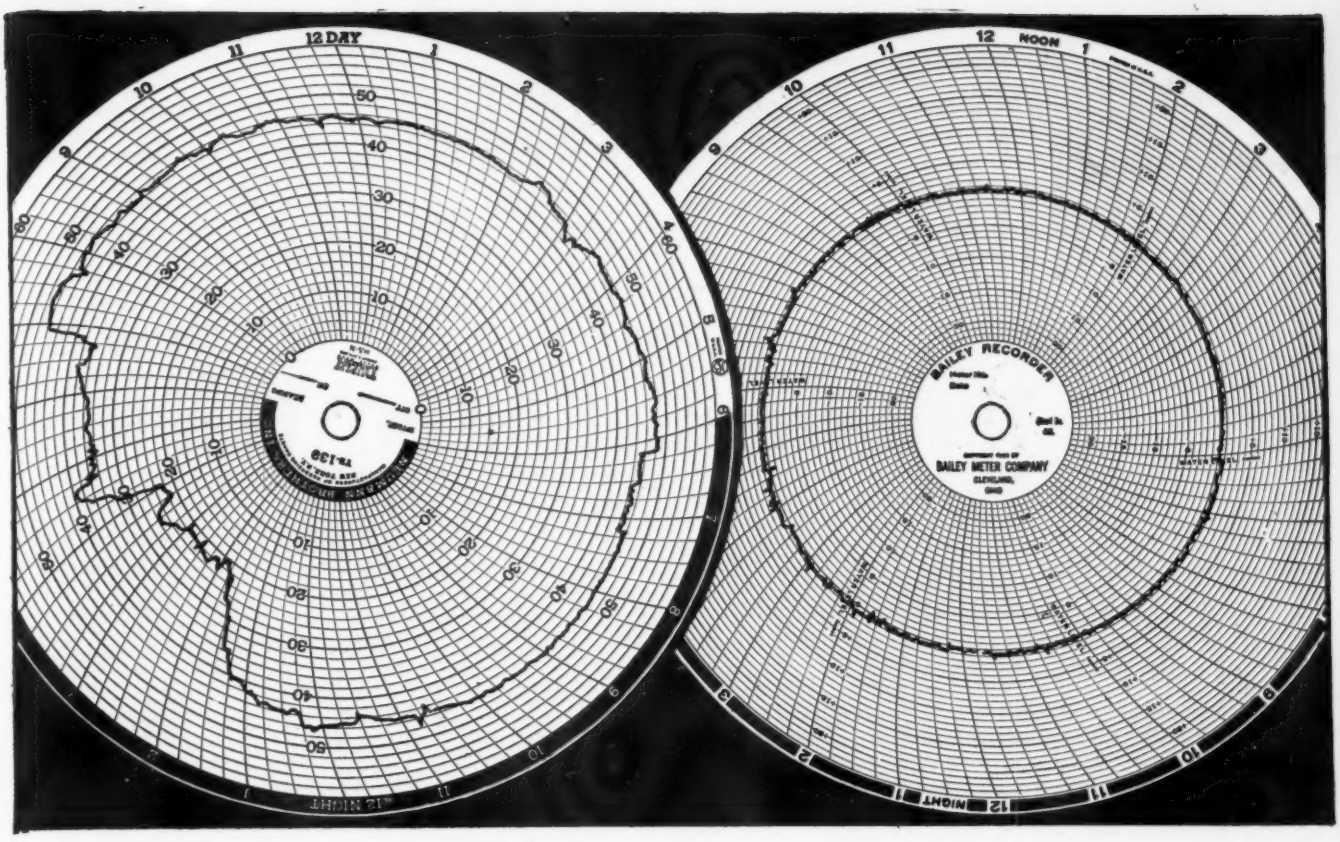



# COPES FLOWMATIC CONTROLS

## water level within plus-or-minus ½-inch

WITH the load range from a minimum of 200,000 to a maximum of 480,000 pounds of steam per hour on this 675-psi, 900-F Combustion Engineering three-drum boiler, two-element COPES Flowmatic Control is stabilizing water level within plus-or-minus one-half-inch. Feed is divided between two lines, with a relay-operated Flowmatic Valve in each line.

Results have been uniformly satisfactory over the five years since the first COPES Flowmatics were placed in regular service. Three other steam generators in the station have since been equipped with duplicating COPES Flowmatic Control.

The charts above are taken from Bulletin 467, an 8-page performance report on this installation. This report reproduces two other sets of charts, as well as a sectional view of the type of boiler in service and plant photographs. This informative publication is yours for the asking. Write—on your letterhead, please—for a copy.

NORTHERN EQUIPMENT COMPANY

771 GROVE DRIVE, ERIE, PENNSYLVANIA

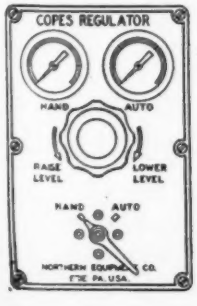
Feed Water Regulators, Pump Governors, Differential Valves, Liquid Level Controls, Reducing Valves and Desuperheaters

BRANCH PLANTS: Canada, England, France

*Representatives Everywhere*

## ★ GET CLOSER LEVEL CONTROL WITH COPES FLOWMATIC

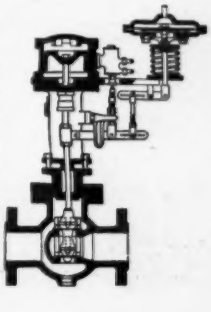
### AIR-OPERATED REMOTE CONTROL




Permits absolute flexibility of installation for COPES Feed Water Regulators of either simple-level-control or two-element Flowmatic type. COPES transfer switch and control panel illustrated provides remote positioning of feed valve from boiler operating board or any other desired point. Air is used as the operating medium. Dependable performance is demonstrated daily in many COPES-equipped high-duty steam-generating stations.

### PRESSURE REDUCING VALVES

Ideal for those applications where results not attainable with "stock" valves are desired. There are eight types, direct-and relay-operated, from which COPES engineers select the one best suited to demands of the individual installation, then design ports and pressure range for the specified conditions. Low friction, accurate balance and ample power. Available as single units or for multiple installations. COPES Master Control permits remote operation.



# TERROR--

## The Scream of "Fire" in a Movie

THOSE OF US who attend places of entertainment—in fact, any place where large crowds gather—have an unholy fear that some unstable individual will scream "fire," and thus precipitate a panic. With this action, one thoughtless person may defeat all that engineering and science can do to safeguard life where gatherings convene, by causing mass hysteria.

Now, read the following paragraph, slightly changed to prevent any suit on the basis of "similarity to any person living or dead."

"*Forecast of a recession*—Time is placed between July 1st and October 1st. It is time for you to get aggressive, to develop plans to cope with the recession. You cannot avoid it, but you can minimize its effects on business, on your profits, on your community. It is your responsibility and duty to take action now."

This is only one of seven or eight similar paragraphs, which begin letters sent out by "economic experts and consultants." Isn't this the call for panic and hysteria—isn't this a cry for mass terrorism?

Several economists in this country—whose position of trust has been that of advising companies and organizations—seem to vie with each other in foretelling the doom of our present business cycle. And, as sound conditions seem to prevail in spite of their gloomy prophesy, they scream more frantically in their efforts to create the panic that will conform to their dire predictions.

To me, this is the greatest disservice these people can perform. They are not productive in the sense that they create goods. All they do is claim that if you follow their advice you will be able to build a storm cellar in which you may survive the prophesied economic cataclysm.

If there were only penalties that could be exacted! If you bet wrong on a horse race, you lose your money. If you incite a riot, the city, state and federal authorities take you to task. Unfortunately, there is no punishment for the economic gypsies who sing these songs of impending distress.

Regardless of the correctness of their predictions, this economy of ours must prevail. Sane business men will continue to use sound judgment in keeping their houses in order to weather the vicissitudes of our free-enterprise system. And in doing this, they will not be fools enough to place the very existence and future of their companies in the hands of men whose melancholia causes them to create an atmosphere of fear.

Mistakes in judgment are not caused so much by the things we don't know, but more by the things we *do* know that are wrong.

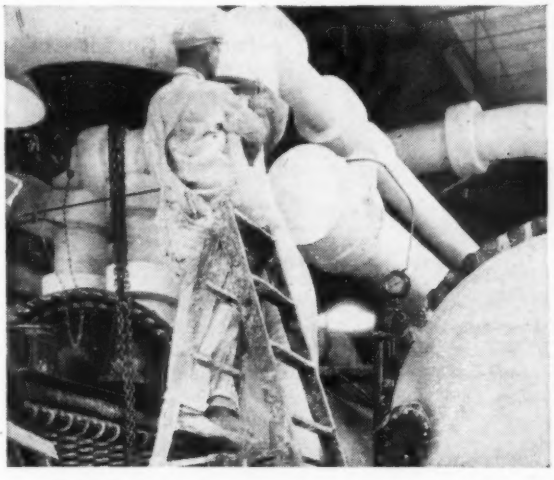
George Edwards

Engineer

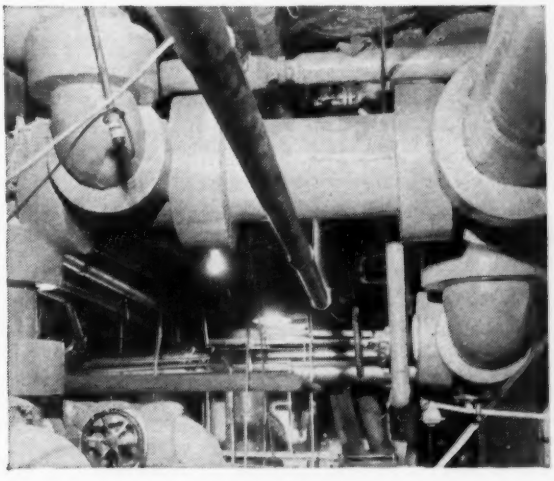
# The RIGHT INSULATION, correctly applied, NEVER GROWS OLD

**ENGINEERING:** In planning your insulation job, first call in an experienced insulation engineer. Johns-Manville . . . Insulation Headquarters for more than 75 years . . . maintains a staff of insulation experts. Each man knows how to take the guesswork out of your job . . . make it "*right* the *first* time."

**RIGHT INSULATION:** Any insulation will save money—but only the right one will save the most for the longest period of time. Johns-Manville makes a wide range of insulations for every service and temperature. One of them, J-M 85% Magnesia, is the most widely used of all industrial insulating materials.



**CORRECT APPLICATION:** No insulation is better than the man who installs it. J-M Insulation Applicators are industry's first choice for completely efficient jobs because: (1) They are trained in all phases of insulation application. (2) They employ skilled mechanics and up-to-date application methods.



**28 YEARS YOUNG!** Back in 1919, J-M 85% Magnesia was installed in the boiler room of the Rice Hotel, Houston . . . engineered right and installed right it is still cutting fuel costs—providing efficient service. Let us help you with your insulation problems. Write Johns-Manville, Box 290, New York 16, N. Y.

# JOHNS-MANVILLE *First in* INSULATIONS

# POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS

## Diesel Men Discuss Fuels, Supercharging, Bearings

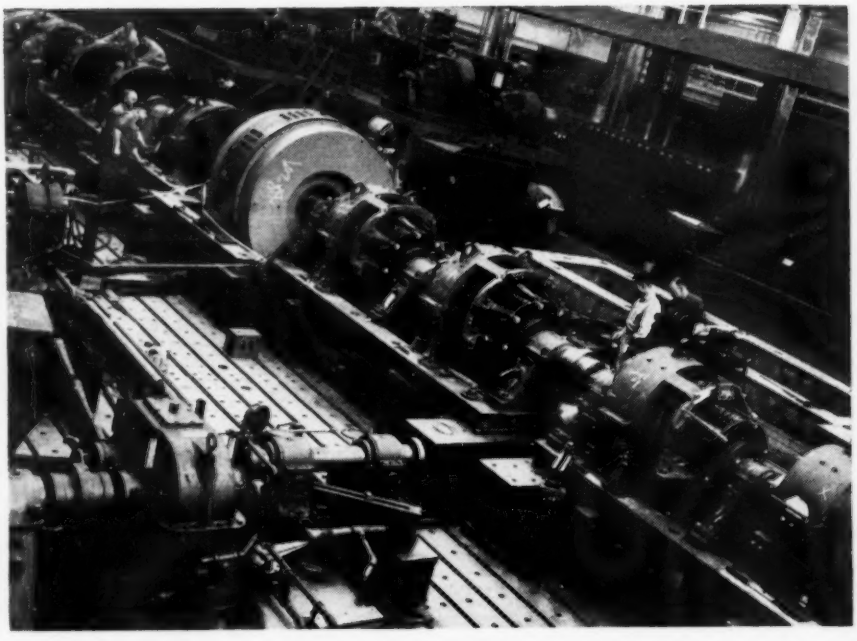
► With a program of unusually practical and timely interest, the 19th National Oil and Gas Power Conference of the Oil and Gas Power Div, ASME, was held May 21-24 at Hotel Statler, Cleveland. Over 400 engineers, representing manufacturers and users of diesel equipment, attended.

Outstanding success attended the innovation of a pre-conference lecture series on May 20 on the subject of fuel oil, covering its production, physical and chemical properties, and combustion. Designed to bring to users of fuel oil the latest thinking of specialists in the field, the all-day program was attended by about 100 engineers. Complete text of the three lectures will be published in the near future; copies may be purchased from *American Society of Mechanical Engineers, 29 W 39th St, New York* 18, *N. Y.*

At the opening session, R H Miller, Nordberg Mfg Co, reported on tests of the dual-pressure internally cooled supercharging system. These tests indicated that conclusions reached by theoretical analysis, and presented at the 1946 conference, were substantially correct. Discussion raised the question of applicability of results from tests made under simulated supercharging conditions because of inability to obtain a suitable turbocharger. Turbocharging equipment for this supercharging system is now under development, and tests will be made with it to confirm results reported in the paper.

A session on fuels included a brief report on results with vegetable oils as fuel for a diesel engine, presented by A W Baker and R L Sweigert, of Georgia School of Technology, and a valuable discussion of the importance of fuel as one of the factors involved in diesel smoke, by Rene Bender, Sinclair Refining Co. Of particular current interest was a paper on the diesel fuel situation, by E F Miller and F L Nelson, Socony-Vacuum Laboratories. It reviewed comprehensively the trends in various production and consumption

(*Continued on page* 192)



## NEW POWER UNIT SPEEDS STEEL OUTPUT

**More than 70 ft of rotating electrical machinery make up this auxiliary motor-generator set under construction at E Pittsburgh, Pa., plant of Westinghouse Electric Corp. Longest ever built by the company, it will soon be installed in one of the nation's big steel mills to help roll steel strip at nearly a mile-a-minute clip. The set consists of a 1500-hp main driving motor, seven booster generators and three exciters. Output of the generators is fed into the big motors driving the mill to compensate for varying resistances and to keep each motor running at a constant speed in relation to the other motors**

## COMING EVENTS

**July 7-9—Smoke Prevention Assn of America,** annual meeting, Royal York Hotel, Toronto, Ont., Canada. Columbus D Behan, secretary, 159 N Clark St, Chicago, Ill.

**Aug 17—New England States Assn of Power Engineers,** meeting, Hotel Statler, Boston, Mass. Dudley G Kimball, chairman, 55 Clifton St, Dorchester 25, Mass.

**Aug 25-28—National Assn of Power Engineers,** meeting, Hotel Statler, Boston, Mass. A F Thompson, director of exhibits, 176 W Adams St, Chicago 3, Illinois.

**Aug 26-29—American Institute of Electrical Engineers,** Pacific general meeting, Hotel San Diego, San Diego, Calif. P M Klauber, 233 W Juniper St. San Diego 1, Calif.

**Aug 28-Sept 13—Engineering & Marine Exhibition,** Olympia, London, England. Kenneth W Bridges, K W Bridges & Sons, Ltd, Grand Bldgs, Trafalgar Sq, London, W C 2, England.

**Sept 2-9—Fuel Economy Conference,** The Hague, Netherlands. H C Forbes, treasurer and secretary, Executive Committee of U.S. National Committee, World Power Conference, 4 Irving Pl, New York 3, N. Y.

**Sept 8-12—Instrument Society of America,** second annual instrument conference and exhibit, Stevens Hotel, Chicago. Richard Rimbach, exec secy, 1117 Wolfendale St, Pittsburgh 12.

**Sept 22-25—Assn of Iron & Steel Engineers,** meeting, Hotel Wm Penn, Pittsburgh, Pa. John B Harmon, exhibit mgr, Empire Bldg, Pittsburgh.

# POWER PLANTS

Dravo-built power and boiler plants, and major Dravo equipment installations, supply all types of industry with steam, electricity, blast air, liquid pumping and related services for the myriad requirements of modern productioneering.

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Dravo experience and facilities are described more fully in Bulletin BR-504; address Power Department, Dravo Corporation, 300 Penn Avenue, Pittsburgh 22, Pa.

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mum of 10 ppm of ionized solids, or as little as 1 ppm. A built-in controller indicates actual quality of all treated water leaving unit. No auxiliary analytical tests are required. Controller measures electrical resistance of the treated water. It is an accepted fact that water having a resistance of 50,000 ohms contains not more than 10 ppm of ionized solids. Therefore controller is adjusted to actuate the red light as soon as resistance of treated water falls below 50,000 ohms.

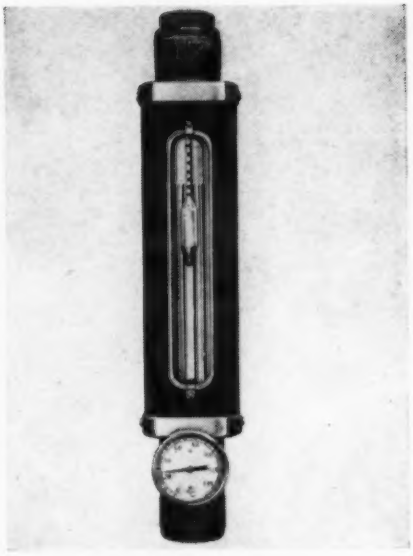
When a higher quality of water is required controller is easily changed to actuate the red light when water falls below desired higher resistance. Maximum setting on standard controller is 500,000 ohms, or the equivalent of about 1 ppm of dissolved solids.

Four columns containing alternate beds of ionic cation and anion exchange resins constitute bulk of unit. Water is passed through the four columns in series where cation resins transform dissolved salts present in raw water into acid and anion resins then absorb acids.

*Filt-R-Stil* demineralizers are available in capacities from 8 to 1200 gph. When red light on the controller glows continuously, the resins are exhausted and have used up their capacity for demineralization. They can then be regenerated by flowing dilute acid and alkali solution over them. They are then rinsed and are ready for use. These cycles of use and regeneration may be repeated indefinitely. **Dept P, Exchange products dept, American Cyanamid Co, 30 Rockefeller Plaza, New York 20, N. Y.**

## Universal-Joint Coupling

SUPERFLEXIBLE COUPLING consists of two single couplings, combined with center plate adapter. New model has twice torsional resilience of a single coupling. A preloaded *Neoprene* biscuit provides torsional resilience. Acting as a universal-drive connection, the coupling accommodates offset and angular misalignment of shafts. With no metal-to-metal contact the coupling does not require lubrication, absorbs vibration, reduces bearing wear and is dielectric. *Double Morflex* available in ten sizes of 13 to 725 ft-lb of torque. **Dept P, Morse Chain Co, Detroit 8.**



## Specific-Gravity Testers

IMPROVED CONTINUOUS-LIQUID specific-gravity indicator is for continuous indication of fluid specific gravity in closed piping systems. It serves in distillation work and with all process systems in which draining of sample batches is considered tedious or hazardous. This tester is sturdily constructed to withstand heavy line strain, but at the same time it is attractive in appearance. Suitable brackets, bezels and lighting accessories are available for adapting the device for front- or rear-panel mounting.

Standard construction includes carbon steel, bronze, stainless steel or *Hastelloy*. Needle control valves, thermometers and hydrometers are built into the compact unit. High visibility by hydrometer and thermometer is claimed. **Dept 6G-B, Fischer & Porter Co, Hatboro, Pa.**

## Silica-Removal Unit

NEW APPARATUS employs a standard demineralizing plant consisting of a *Liquon* hydrogen-zeolite unit followed by a *Liquon* anion exchange unit. To effect elimination of silica, a fluoride, such as sodium fluoride, is added to raw water entering hydrogen-zeolite unit. Here, fluoride is converted into hydrofluoric acid by a resin type of acid-regenerated cation exchange material known as *Liquonex CR*. The hydrofluoric acid combines with silica to form fluorosilicic acid, while, at the same time, *Liquonex CR* converts raw-water hardness into acids corresponding to salts present. In a modification of this process, silica is removed without adding fluorides by a special anion exchanger following the standard demineralizing equipment. **Dept P, Liquid Conditioning Corp, 114 E Price St, Linden, N. J.**

## Gage Case

ACALOY CASE is made of a high-compression molded aluminum alloy. Case surface is treated by a patented process to prevent corrosion. It is claimed that the case withstands 1500-hr salt-spray test. Over this treated surface there is a black baked-on finish. Case is said to be weatherproof as it is provided with a synthetic rubber-sealing gasket and a stainless-steel snap ring. This new case accommodates safety blowout disks, which are supplied when required. **Dept P, Helicoid gage div, American Chain & Cable Co, Bridgeport, Conn.**

## Welding Tip Cleaners

WYPO TIP CLEANERS are available in two individual packages, known as Set No. 1 and No. 2. They clean oxyacetylene welding and cutting tips. Set No. 1 contains twelve cleaners for drill sizes No. 75 to 49. Set No. 2 contains nine cleaners for drill sizes No. 48 to 30. *Wypo* tip cleaners are made of corrosion-resistant stainless steel and each set comes in a compact, easy-to-carry leather case. **Dept P, Air Reduction Sales Co, 60 E 42d St, New York 17, N. Y.**

## Binding Post

THIS NEW BINDING POST offers five ways of connecting leads: (1) Permanent clamping of wire up to No. 12 through center hole. (2) Looping of wire around center shaft and clamping it. (3) Plug-in connection of a standard $\frac{3}{4}$-in. center banana plug. (4) Clip-lead connection by removing hexagonal-shaped phenolic head. (5) Spade lug connection.

In addition to meeting need for a multipurpose electrical connector, *DF*30 binding post provides complete insulation from mounting panel. Extra-strong hard phenolic material assures rugged construction for head and sliding members. Thus, it is permissible to tighten hexagonal head with a standard $\frac{1}{2}$-in. socket wrench. All metallic components are recessed, assuring a dead front for instruments and op-

(*Continued on page* 170)

**POWER** brings this monthly survey of new equipment as one of its many reader services. In requesting additional information from manufacturers, please identify the source of your inquiry by referring to Dept. P.

AN EXAMPLE:
This is a diesel engine exhaust manifold outlet fabricated with Tube-Turn welding fittings taken out of regular stock. Replacing castings—eight such outlets to an engine save .71 lbs. per horsepower. Seems little, but multiply this by 1000 and you have 710 pounds of dead weight eliminated.

# "It can be done!"

SO MANY piping problems are solved with the use of welding fittings that it pays to see your Tube-Turn Distributor first. He handles *the fitting that becomes part of the pipe.*

Tube-Turn welding fittings—engineered in design, built with closer tolerances than code requirements, available in a wide variety of styles, sizes and materials—often offer just the right answer to what sometimes seems an impossible problem. Welding fittings for example, permit extremely close nesting without flow loss. Tube-Turn welding fittings have uniform wall thickness and full circularity which allows them being cut and used at odd angles. Order one, one-hundred, or a thousand Tube-Turn welding fittings of the same size and part number and they will be dimensionally uniform. They can be and are being used in production line assembly of equipment.

For full information about the more than 4000 types and sizes in the complete line of Tube-Turn welding fittings and flanges—for details about the wide range of special metals and alloys—for the name of your nearest distributor, write to—

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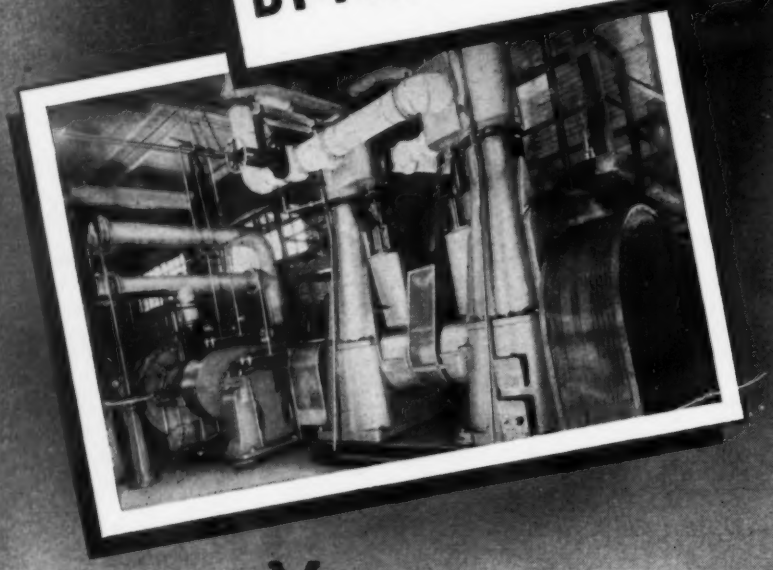

Make your STEAM do two big jobs . . . eventually one of them at little or no cost. With proper heat balance your steam can provide—FIRST, power for driving equipment, and SECOND, heat units needed for processing or heating.

Use boiler steam to run a Troy-Engberg Steam Engine. THEN use the exhaust in your heating or processing lines. Drive your pumps, stokers, generators, blowers or compressors with By-Product Power. Use a Troy-Engberg Steam Engine as a reducing valve and your power cost saving will pay for the engine in a very short time.

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TROY-ENGBERG
STEAM ENGINES • GENERATING SETS • GENERATORS

## Pump Q and A

(*Continued from page* 122)

### SOME SPECIAL PROBLEMS

**Q 11—A duplex steam pump operated satisfactorily at low and medium speeds, but as speed increased the pump hesitated, then stalled when the right-hand steam piston reached the head end of stroke. What caused this condition?**

A—Investigation showed that the left-hand steam-valve adjustment was off center, and that there was less than normal clearance between the cradle end of this valve and the inside of the steam chest. As the pump stroke lengthened with increasing speed, the valve moved farther and farther until contact with the steam chest stopped it. Further motion of the valve rod then lifted the valve from its seat, opening the steam chest and all ports on the left-hand side of the pump to exhaust. Fig. 3 shows this action greatly exaggerated. After the chest was chipped out to provide normal clearance and the valves correctly adjusted, the pump ran perfectly at all speeds.

**Q 12—Two identical vertical simplex direct-acting boiler-feed pumps were installed in a new plant. The first pump seemed all right, but later developed an irregular twisting motion of the piston-rod crosshead. The second pump had to be run at least twice as fast as the other unit to carry the same load. What caused this trouble?**

A—Lateral swelling of relatively hard piston packing was the cause. In the first pump the packing was set out against the cylinder liner. Because the pump was in use, gradual swelling locked the packing tightly in the piston groove, 4*A*. Further swelling caused abnormal friction between packing and cylinder liner. Second pump was not in use when its packing swelled laterally to jam in the piston groove, Fig. 4*B*. Consequently, there was clearance between the packing and the liner to permit considerable leakage. Each liquid piston was remachined to provide packing clearance in its groove, thus allowing the packing to float and operate as it should.

**Q 13—A small duplex direct-acting pump with piston steam valves short-stroked badly. Increasing the lost motion in the valve gear, in an effort to increase the stroke, required increased steam pressure to operate the pump. What was the cause?**

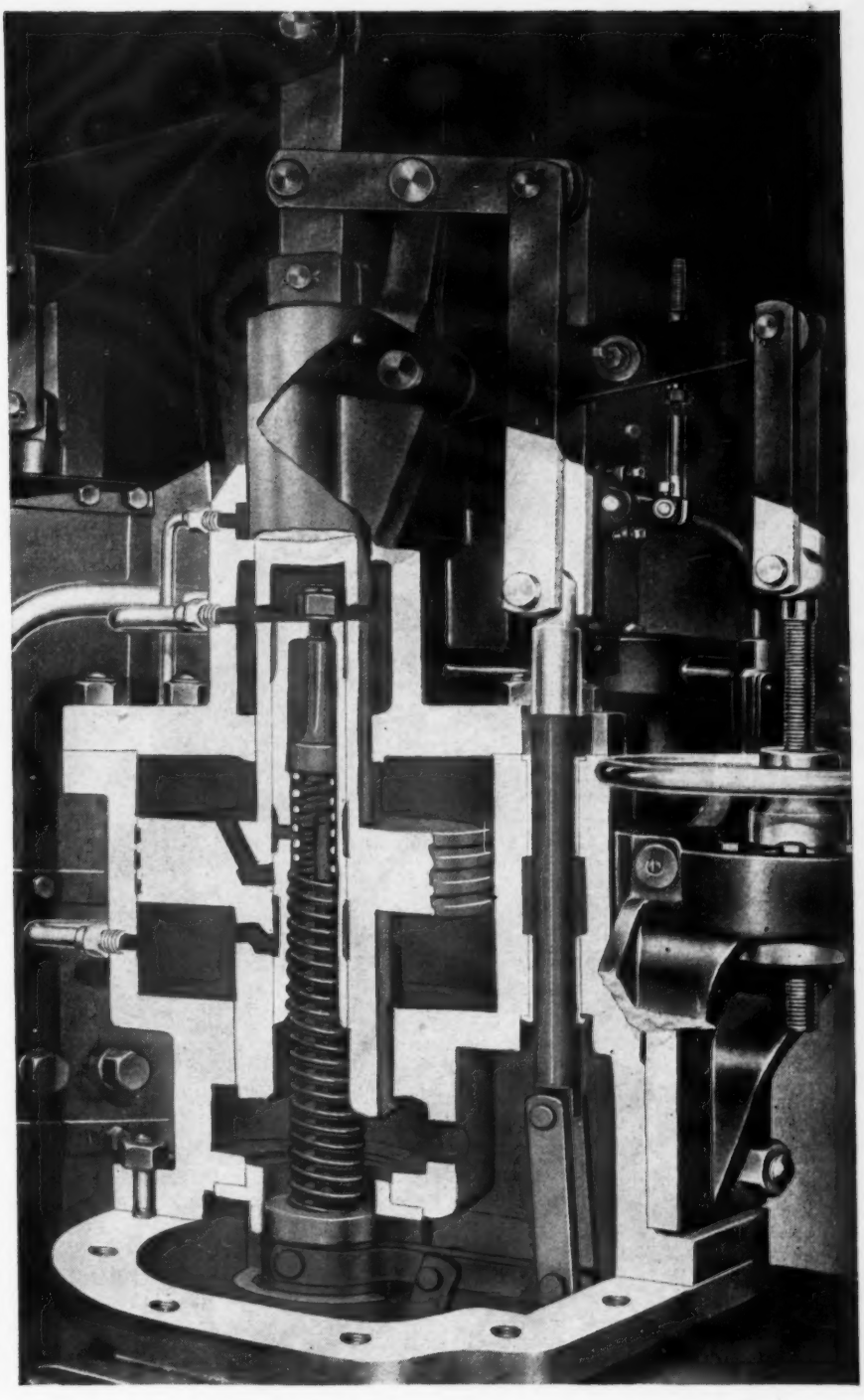
A—It was found that the one-piece rings on the piston valves were slightly

**Inside Knowledge on Lubrication Problems**

**—CLOSE CLEARANCES—**

This is One of a Series of Messages on Common Problems in Your Plant

# Bridle FOR Horse-Power!



THIS IS ONE of several types of governors for steam turbines. It acts as a bridle on horse-power.

Its efficiency depends mainly on oil. As the speed of the turbine tends to change with the load, the pressure of the oil fed to the governor varies. These changes in pressure cause the large piston to move up or down, and thus regulate the flow of steam to keep the turbine speed constant.

Clearances inside the governor are exceptionally close. Yet every part must operate smoothly, sensitive to the slightest variation in pressure. If the oil deteriorates and forms deposits, it may cause the governor to stick or to operate sluggishly.

Gargoyle D.T.E. Oil 797 has exceptional resistance to deterioration. It fights off the effects of heat and oxygen, and contains special rust inhibitors. Emulsions and sludge are minimized. These same qualities that make it the outstanding oil for turbine lubrication also assure maximum dependability in governor operation.

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and Affiliates: Magnolia Petroleum Company
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SOCONY-VACUUM

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**65** lbs. of machine parts in Louisville had to get to Dallas *fast.* Picked up at 5 PM on the 25th, they were delivered at 7 AM on the 26th. For complete door-to-door service, the Air Express charge was only **$15.96!**


undersize, permitting them to open to an unusually large gap. Live-steam leakage through this gap, and through the steam port to the end of the cylinder, created a live-steam cushion, which stopped the main piston as soon as it covered the exhaust port. After the piston valves were fitted with 2-piece compressor-type rings, which provided a seal at the gap, the pump operated at full stroke, and responded normally to adjustment of the valve setting.

**Q 14—At the end of each stroke of a duplex direct-acting boiler-feed pump the discharge-line check valve slammed shut with a shock that shook the entire boiler-feed line. How was this condition corrected?**

A—The steam end of the pump had too much cushion for boiler-feed service. Increasing the lost motion to make the unit run at rated stroke retarded its action so there was a definite pause instead of a slight overlapping of stroke at each reversal. Slamming of the check valve was eliminated by (1) drilling cushion release holes between the steam and exhaust ports, as at *A* Fig. 3, and (2) reducing the lost motion to a normal amount. Careful adjustment permitted satisfactory operation during boiler blowdown periods when the pump had to operate at 50% above its rated capacity.

**Q 15—A vertical simplex direct-acting bilge pump with a discharge air chamber could not operate at more than one-half rated speed without developing a bad water hammer. Why?**

A—A combination of suction and discharge piping, together with the discharge air chamber, created a condition where pressure in the chamber dropped to less than one-half rated discharge value while the pump paused at each end of the stroke. At the start of each stroke, lack of resistance on the discharge side permitted an unusually high piston velocity, which the suction column could not follow. As pressure built up in the discharge air chamber to retard the piston, the suction column caught up with the liquid piston with a severe shock or water hammer, at about mid-stroke. Elimination of the air chamber made it possible to operate the pump at rated speed. It was recommended that the cushion chamber be transferred to the suction side.

**Q 16—What caused a severe knock, in the liquid end of a vertical simplex direct-acting boiler-feed pump, occurring only at the start of the upward stroke?**

A—Liquid pistons in such pumps are usually fitted on a taper on the piston-rod, and held by a nut. When slightly loose, the piston seats quietly on the

*Good fittings are hard to find*

# SAVE 7 PER TRAP with Super-Silvertop

● When you see the meager results of a strenuous search for "hard-to-get" fittings, you'll want to make sure those fittings are not wasted. Trap your equipment with Super-Silvertops and you save as many as 9 fittings per trap installed. It's the built-in U-tube that makes such savings possible; and in Super-Silvertop there are no cored passages, no split gaskets to weaken the design. Find out all the facts about simplified piping with Super-Silvertop—fully described in the book "How To Choose A Steam Trap." Your free copy will be sent on request.

**THE V. D. ANDERSON COMPANY**
1934 West 96th Street, Cleveland 2, Ohio

*and here's how*

Super-Silvertop showing one nipple and one union needed.

Conventional trap using seven fittings and two unions.

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CONDENSATE METERS

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taper under the load of the downstroke. It often sticks on the taper, however, until almost full pressure is developed at the start of the upward stroke. If load is sufficient to start a loose piston off the taper, a severe knock occurs when the piston strikes the piston-rod nut. For present operating pressures, piston-rod nuts must be drawn up very tight, and often retightened after the pump has been in service a short time.

## Pyrometer Leadwires

(*Continued from page* 71)

**Testing Leadwire.** For the utmost in accuracy and service, extension leadwire must be rigidly tested for conformance to various specifications because its thermoelectric characteristics are extremely important in the final accuracy of the pyrometer installation.

Testing is done by welding the two conductors together at one end, thus forming the hot junction of a thermocouple. The junction is then immersed in a hot oil bath whose temperature is precisely measured. The other end of leadwire stock forms the cold junction of the thermocouple and is immersed in an ice-water bath. The resultant emf generated is measured by an accurate potentiometer and the indication compared with a standard value for the type of leadwire under test. If the emf is within permissible tolerances, it is acceptable.

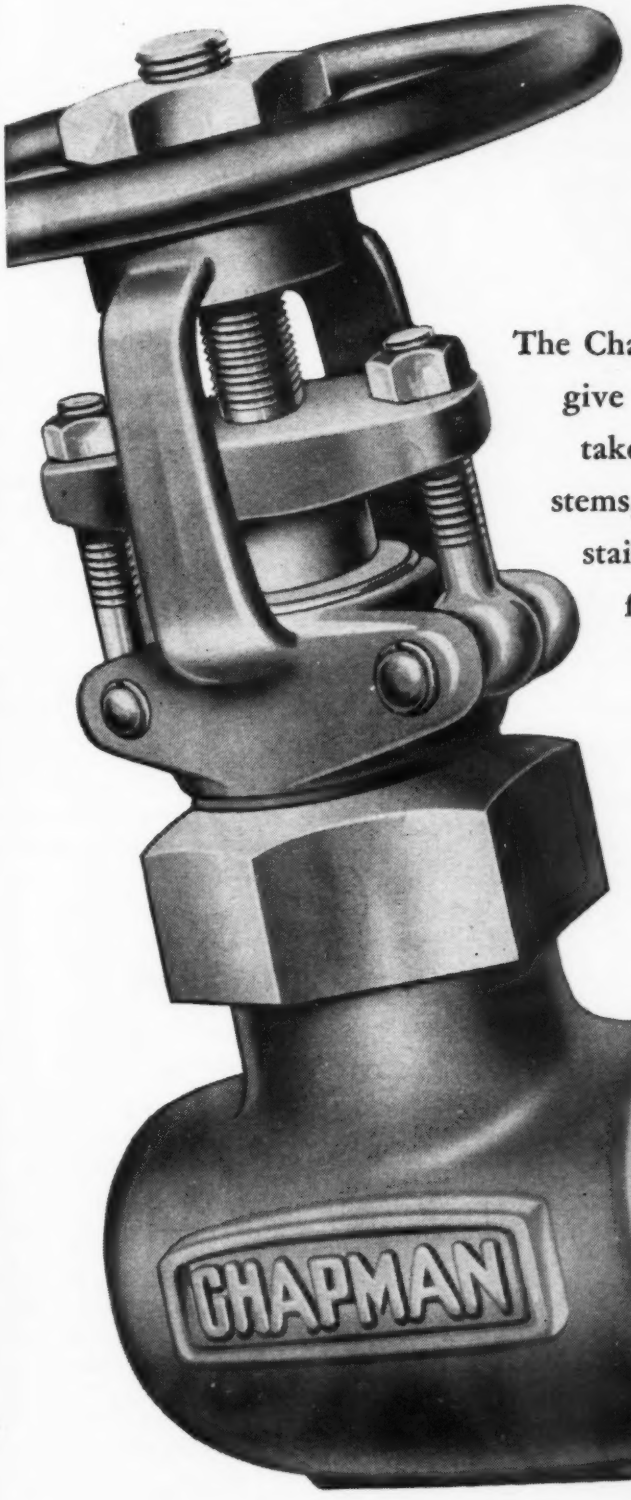
In addition to the thermoelectric tests, the dielectric strength of the insulation is measured. An ohmmeter measures leakage resistance between the two conductors of the cable under open circuited conditions. Since this leakage must be held to a certain limit, only wire whose leakage resistance is not *lower* than the specified value is acceptable.

Because moisture may be a serious cause of insulation leakage, certain kinds are tested after the leadwire has been immersed in water for seven days. Leakage resistance between each conductor and the water is measured by connecting one lead from the ohmmeter alternately to each conductor, while the other ohmmeter lead is immersed in the water. An insulation breakdown test is also made by connecting a high ac voltage across each conductor and the water.

**Installing Leadwire.** Proper installation is of no less importance than the wire itself in accurate pyrometer readings over long periods. Many failures and inaccuracies have resulted from

# CHAPMAN LIST 960

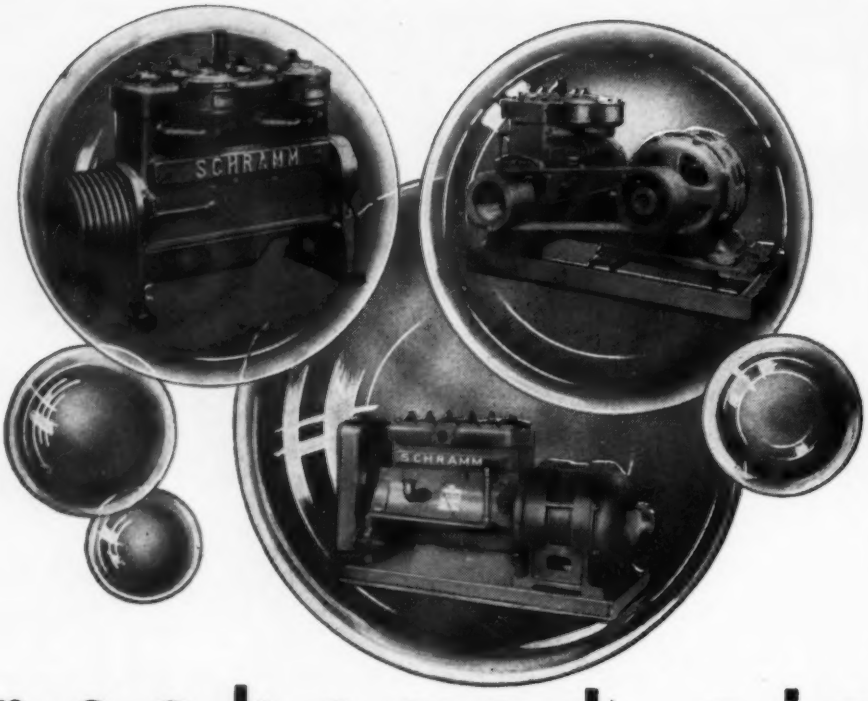
## *A Valve That's Ready for ANY "ENDURANCE TEST"*



The Chapman List 960 is a sturdy gate valve ready to give continuous, trouble-free service, and built to take it. The body and yoke are of forged steel; stems, plugs, and seat rings are of superhardened stainless steel. The bonnet is fitted with a flanged forged steel packing gland which protects the threads of the valve yoke from rusting and corrosion. Chapman List 960 can be re-packed under full pressure because pressure is not transmitted to the valve stem. All parts are made to exact gage and are readily replaceable.

Available in sizes from ¼" to 2" — carbon steel for pressures to 800 pounds at 750° F. For higher pressures, specify List 990.

**The Chapman Valve Mfg. Co.**
INDIAN ORCHARD, MASS.




# packaged air

is more than a pipe dream. SCHRAMM COMPRESSORS, for example, package air every day for industrial consumption. The selection of SCHRAMM AIR COMPRESSORS is influenced by features that include: (1) 100% water cooled; (2) forced feed lubrication; (3) mechanical intake valve; (4) compact, lightweight. Designed for heavy duty, continuous service and minimum attention. There's a SCHRAMM AIR COMPRESSOR for your every need, in sizes ranging from 2 to 600 cubic feet displacement.

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poor electrical connections and grounded wiring.

Whenever possible, run leadwires in conduit to protect them against mechanical injury. Splices must be soldered, then wrapped first with rubber tape and next with friction tape. It is extremely important that the polarity markings throughout the wiring between thermocouple and indicating instruments be followed and that the wires be connected in the proper polarity at all terminals. For example: The red negative leads common to most extension lead-wires, must first be connected to the negative terminal on the thermocouple; then the red-colored conductor has to be spliced to only a red-colored conductor throughout the wiring and connected to the negative terminal of the indicating instrument. These simple rules assure accurate results and dependable service.

Use of improper leadwire or improperly installed ones impairs both the accuracy of indication and the control of the process variable. Effect of wide variations in ambient temperature becomes a serious detriment in obtaining accurate indications unless the proper extension leadwire is used. Careless wiring, poorly soldered or unsoldered splices, carelessly taped splices or mechanical abrasions of the leadwire insulation can result in either complete or partial failure of the pyrometer system. But the selection of the proper kind of leadwire, and careful adherence to the few simple rules necessary for a good extension wiring job, results in not only accurate measurement and control, but also an ultimate saving in maintenance and repair.

## Specifications

(*Continued from page* 91)

weights, as well as a detailed list of the steel included. On jobs of this kind there is sometimes "a loose end swaying in the breeze," as the result of failure to specify who furnishes what. One good paragraph, on drawings reads:

"The successful Bidder will be required to prepare and submit drawings showing design and details of the equipment for comments and approval. Two sets of prints shall be furnished at each transmittal, and no extra charge to the contract price will be allowed for said drawings and prints.

"The Contractor shall furnish free of charge additional prints of all working drawings required by the Purchaser.

# BACK PRESSURES UP
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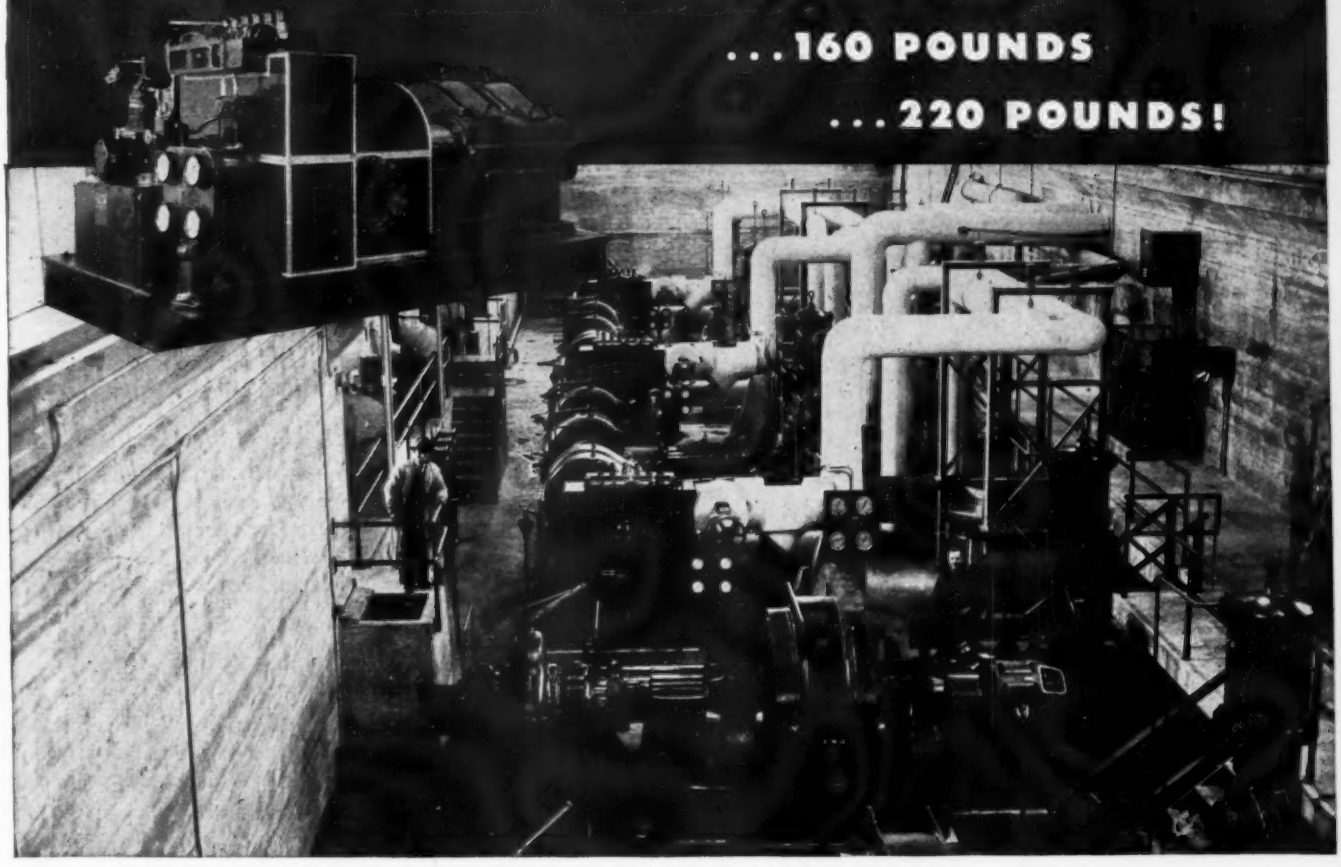
## ...220 POUNDS!



***Result: Lowest power costs at new synthetic rubber plant with Worthington-Moore turbines***

In Canada's new government-owned synthetic rubber plant, operated by Polymer Corporation, Ltd., Worthington-Moore high back pressure steam turbines have permitted considerable savings in power costs. In this, Canada's largest steam plant installation, engineered by H. G. Acres and Company, power is produced as a by-product, since all exhaust steam is used for plant operation.

Three Worthington-Moore 1650-hp. geared multi-stage turbines are illustrated above as installed. These topping turbines operate with steam at 400 lbs. initial pressure, 650°F. temperature, and exhaust against 160 lbs. back pressure. Two 1000-hp. Worthington-Moore turbines, exhausting to 220 lbs. back pressure, were also selected.

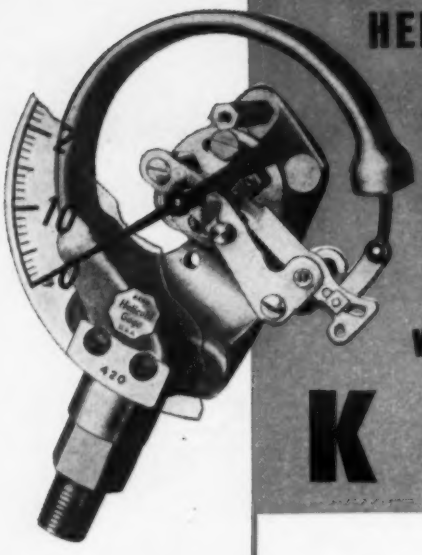
**Save Money in Modernizing Steam Plants**

Worthington-Moore turbines operating against unusually high back pressures have enabled many plants to install modern high-pressure boilers without scrapping existing low-pressure apparatus. Write for complete details. *Worthington Pump and Machinery Corporation, Moore Steam Turbine Division, Wellsville, New York.*

**WORTHINGTON**

T4-9

A GREAT TEAM IN STEAM



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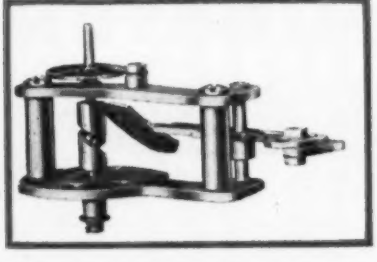
K MONEL

**With superior spring characteristics and high resistance to corrosion, K Monel is unequalled for certain difficult pressure gage applications. In actual service under the worst corrosive conditions, such as Hydrogen Sulphide gas or oil, Helicoid Pressure Gages with K Monel Bourdon Tubes have remained accurate ten times longer than gages with stainless steel tubes.**

**K Monel Bourdon tubes** are made of Korex tubing, with extra-smooth inside wall, for all pressures from 30 p.s.i. to 10,000 p.s.i.

- **These tubes are fused** to forged Monel sockets and tips—no solder, no welding rod—providing an integral Monel system. Heat-treated to obtain maximum spring properties in tube.
- **K Monel Gages cost no more** than stainless steel tube gages. Yet they are infinitely superior for prolonged accuracy and low hysteresis effect.
- **Try Helicoid Gages now** with K Monel tubes. Send for your copy of the new Helicoid Gage catalog.



**The Helicoid Movement is one of many exclusive features of the Helicoid Pressure Gage.**

ACCO

HELICOID GAGE DIVISION

AMERICAN CHAIN & CABLE

Bridgeport 2, Connecticut

TRADE MARK


Unless otherwise notified in writing by the Purchaser, no work shall be commenced or material ordered until the working drawings are approved in writing. The Contractor shall be responsible for dimensions and details on the working drawings, and approval of details by the Purchaser will not relieve the Contractor of any responsibility for the design and execution of any part or features involved in the prosecution of the contract."

Detailed information is a necessity if you are to evaluate your bids correctly. Pieces of machinery that look alike on the outside may be quite different inside. Moreover, one design may strike you as being better than another. If the low bid is based on comparatively poor design, or employs less satisfactory material, you should know it, and decide for yourself if you desire that unit or a more expensive one. Response to information in such a paragraph goes a long way toward helping decide on each item.

For those who do not write specifications too frequently, the "Specification Check-Off Chart" (p 91) is helpful. This chart does not cover the entire field of specs because each job has peculiarities of its own. Look for these peculiarities, and modify paragraphs accordingly. Meanwhile, by consulting this chart, you may avoid the embarrassment of leaving out some phase of the job.

## Reader's Problems

(*Continued from page* 116)

pumping river water is: 720 + 168 = $888 a year. Cost of city water at $1.50 per 1000 cu ft is $3360 per yr. Saving by using river water is $3360 − 888 = $2472 per year. At this rate, investment will return in 3.64 years.

*Miami, Fla.* H M LINTHICUM

### Practical to Pump Water

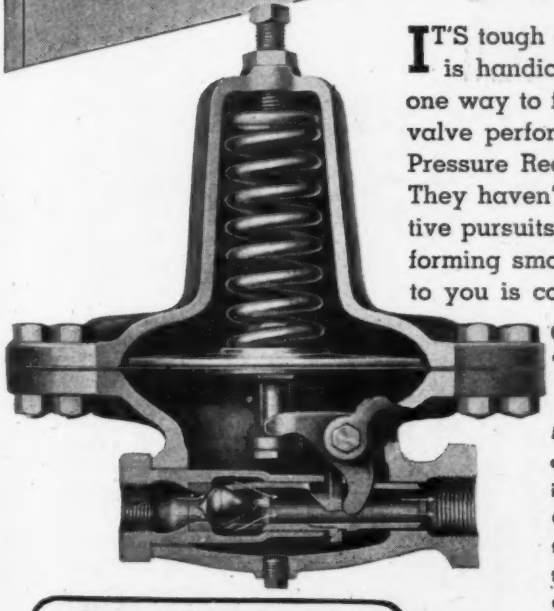
PUMPING RIVER WATER is practical, but it may not be profitable. Power cost and maintenance charges will be small, but fixed charges on the investment may make installing such a unit unprofitable.

Assuming a more or less gradual rise of terrain, a pump in a pit at the plant would require an intake pipe about 2 ft below low-water level. This would result in excavating to an average depth of 16 ft for a distance of 2000 ft. A 6-in. pipe would be necessary for the flow required. On the other hand, if

# IT TAKES MORE THAN THIS TO KEEP 'EM OUT

## INSTALL THESE TO INSURE AGAINST SUCH COST MAKERS

**CASH STANDARD Streamlined PRESSURE REDUCING VALVES TYPE 1000**



IT'S tough going and costly too when production is handicapped by these six culprits. There is one way to fully protect against them as concerns valve performance. The "Streamlined" Type 1000 Pressure Reducing Valve ties 'em hand and foot. They haven't a chance to engage in their destructive pursuits with the Type 1000 on your lines performing smoothly and dependably. The net result to you is continuous savings and no trouble.

Our bulletin "962" gives you the entire "1000" story.

•

**Maximum Capacity When Needed Most • Accurate Pressure Control Under Toughest Working Conditions • Trouble-Free Service • Smooth Operation • Tight Closure • Accurate Regulation • Speedier Production Results • Elimination of Failures • Constant Delivery Pressure • Cost Saving Operation • No Spoilage • Practically Zero in Maintenance Costs.**

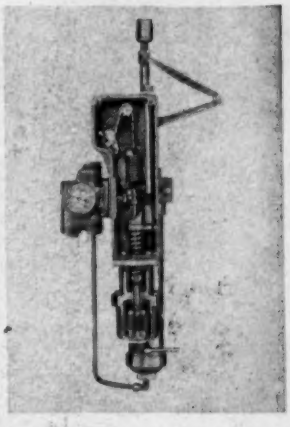
**CASH STANDARD CONTROLS... VALVES**

**A. W. CASH COMPANY**
**DECATUR, ILLINOIS**

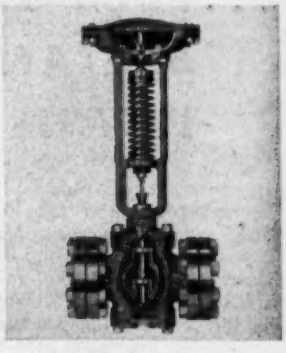
•

**BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES**

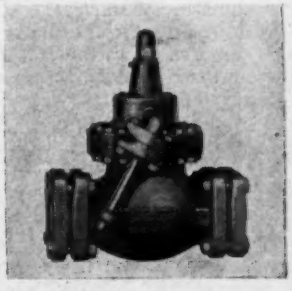
*Send for them*



**Bulletin 963 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers — various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. 16 pages filled with descriptions and applications.**



**Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve — direct operated — direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.**



**Bulletin 956 features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.**

# ROPERS

## *Help Keep Giant Holder Gas-Tight*

## . . . PUMP LIQUID SEALANT TO PISTON SEAL

Because Roper pumps have a well earned reputation for dependability, and because they are constructed with 4 ports for easy installation in confined areas, a large eastern gas works installed 14 Series "F" Ropers on the 10,000,000 cu. ft. gas holder illustrated above.

This giant holder—the piston seal type—utilizes liquid sealant to help form an impervious, gas-tight seal. This sealant constantly seeps through however . . . eventually ends up in one of the 14 independent sumps located at the base of the holder. When an individual sump becomes full, a float switch automatically starts the Roper pump installed next to the sump, and sealant is pumped up to the piston seal at the top of the holder . . . a maximum distance of 378 feet!

Yes, Roper pumps play an important part in the operation of this utility, and they can do an equally outstanding job for you. Built throughout for long-life service, Series "F" pumps embody spiral gears operating in axial hydraulic balance . . . a deep packing box or mechanical seal if desired. Supplied in standard fitted or bronze fitted models to suit specific needs, they are recommended for pressures up to 300 p.s.i. Can be direct connected or belt driven . . . flange or foot mounted.

**GEO. D. ROPER CORP.**
**357 Blackhawk Park Ave., Rockford, Ill.**

*Send for Booklet* **"HOW TO SOLVE PUMPING PROBLEMS"**
Written by engineers for engineers. Contains many helpful ideas regarding installations . . . the type pump most suitable for your particular job.

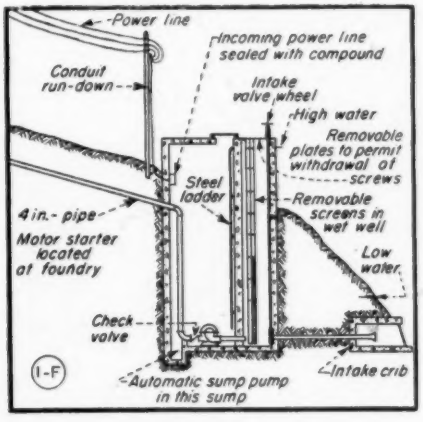
PUMPS ESPECIALLY ENGINEERED TO FIT YOUR REQUIREMENTS

ROPER *Rotary Pumps*

BUILDERS OF PUMPS FOR MANUFACTURING, MARINE, PETROLEUM, AND PROCESS INDUSTRIES


the pump were in a dry well near the river, as in sketch 1-*F*. pipeline excavation would be about 3 ft deep for the entire distance. Pipe size could then be reduced to 4-in. cast-iron bell and spigot. The power circuit could be either a pole line as shown or armored cable. The cable would probably be cheaper since it could be laid in the same trench as the pipe.

If the demand is reasonably constant, one pump and motor would be cheaper and more efficient. Discharge force




and friction head would be about 50 ft. This, together with the 30-ft differential between plant floor and low-water level plus static head at the plant, would probably result in a pump large enough to deliver a 150-ft head.

*Hamilton, Ont.* J A COULDEN

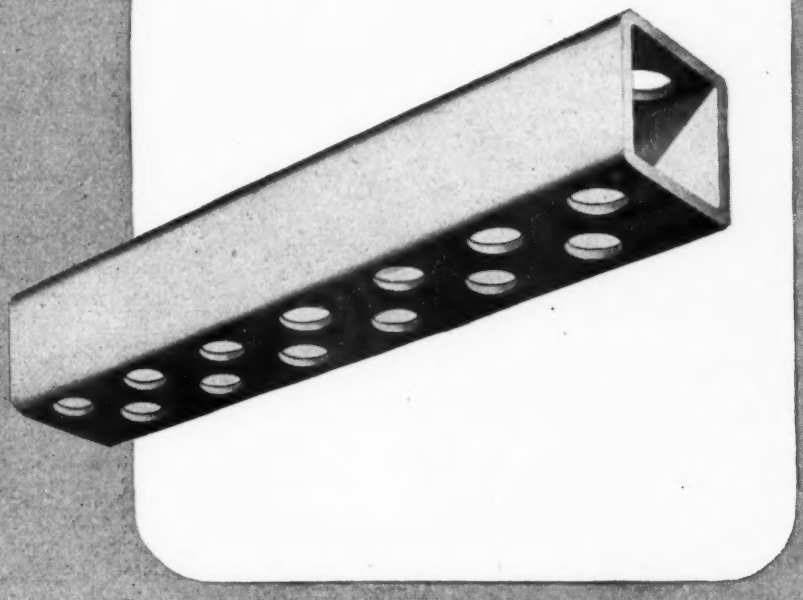
### Stay With City Water

FIRST INVESTIGATE the quality of river water. If it will cause trouble for any reason, including health hazards, don't use it. Assuming river water is satisfactory, and no cross-connection problems come up from the board of health investigate whether water can be taken from the river. In New Mexico water cannot be taken from rivers without permission from the state engineer. With these conditions settled the following figures might be of use:

If city water costs 20¢ per 1000 gallons, then 1,400,000 gal per month costs $3,360 per year. Power for pumping is 100x8.3x60 divided by 33,000x0.60, or 2.09 hp. Difference in elevation is 30 ft and 2000 ft of 4-in. pipe gives a pressure loss at 100 gpm of 12.2 ft per 1000 ft of 4-in. pipe. It is safe to assume 30-ft loss instead of 24.4-ft. Total head, friction plus static, is 60 ft.

I recommend a 3-hp motor and a vertical submerged pump, so the motor is above high water. Pumping time is 1,400,000/100 equals 14,000 min or 234 hr per month. Motor would take 1.6 kw or 234x1.6 equals 374 kwhr per

# For *MAXIMUM* mechanical strength



## CHASE "SQUARE COPPER" bus conductor

YOU get maximum mechanical strength in both directions when you install this Chase Copper Bus Conductor. The reason: it is one-piece *square* bus tube, which was first developed commercially by Chase Brass & Copper Co.

To this basic improvement in bus design, Chase engineers have added still further refinements: ventilating holes in both top and bottom faces, to increase current-carrying capacity . . . rigid, one-piece construction, to save installation time and labor.

Taken together with copper's high electrical conductivity, these features offer everything you could want in a modern bus conductor. Before you decide on any new AC bus installations, send for the Chase Electrical Handbook. For a complimentary copy, simply address Dept. PO-77.

Chase

*the Nation's Headquarters for*
BRASS & COPPER

WATERBURY 91, CONNECTICUT

SUBSIDIARY OF KENNECOTT COPPER CORPORATION

THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

ALBANY† ATLANTA† BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON† INDIANAPOLIS KANSAS CITY, MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† SAN FRANCISCO SEATTLE ST. LOUIS WASHINGTON† *(†Indicates Sales Office Only)*

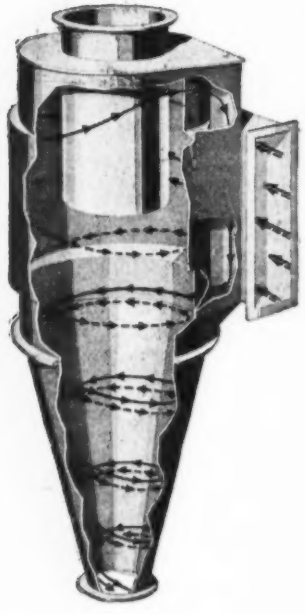
IN DUST RECOVERY . . .

# Performance "paved with good intentions" isn't enough!

**Buell is the champion of Fractional Efficiency Performance Guarantees as the only way to assure the user's after satisfaction.**

Dust, inevitably, is a mixture of coarse particles, fine, still finer, and so on down to low-micron sizes. Almost as inevitably, there will be a critically important fraction of certain fines. You HAVE to know that they will be effectively trapped in your dust control apparatus.

Buell tells you in detail! And nothing less than complete Fractional Efficiency Curves present a true picture.



Buell performance is in a class apart because of its design. The patented van Tongeren harnessing of the otherwise mischievous "double eddy" current is at the heart of the matter. The Shave-off is the pay-off!

What it is and why it makes so vital a difference is the subject of an interesting exposition in "The van Tongeren System of Industrial Dust Recovery". Free for the asking. Write: Buell Engineering Company, 10 Cedar Street, New York 5, N. Y.

buell

Engineered Efficiency in DUST RECOVERY

month. Assuming power costs 1¢ this is $3.74 per month or $44.88 per year.

Estimated costs on initial investment:

| | |
|---|---|
| Pump and motor | $ 375 |
| 2000-ft pipe laid | 2600 |
| 2000-ft power line | 1700 |
| Total | $4675 |

| | |
|---|---|
| Interest 3% on $4675.00 | $140.25 |
| Depreciation 7% | 327.25 |
| Repairs | 120.00 |
| Attendance $50 per month | 600.00 |
| Power | 44.88 |
| Total water cost | $1,232.38 |

Install a duplicate pump or arrange for stand-by service from the city. In either case there would be additional charges. If the plant does not have storage, this has to be added. A pressure tank would be expensive and without it care would be necessary to keep the water consumption below the pump capacity so as not to reduce the head which would overload the motor.

The pump should be at the river. It would not be good practice to draw water any distance; also the plant is too high for it. Without storage at the plant, the pump installation will give so much trouble from varying head that it would be advisable to stay with the city supply, especially since quality of the water is probably a lot better.

*Carlsbad, N M* E A ROBERTS

## Pumping River Water Is a Good Idea

CB SHOULD PUT IN his own pumping station at once and figure it will pay for itself in two years or less. Install a 4-in. 2-stage centrifugal pump that develops 125 psi when powered by a 10-hp motor. This will supply 100 gpm at end of line with 90 psi at 2000 ft.

Locate pump at river 12 in. below low water, and bury pipe below frost line for protection in an emergency shutdown. Put power cable in same ditch. It is not necessary to tunnel railroad track as there are numerous ways of driving pipe through such barriers without digging. Keep pipeline straight, without bends, and keep concrete pumphouse heavy so it cannot shift at high water. Put dual controls on motors, one at each end of line. The 2-pump system should be selected in case of break down or heavy loads.

*Spokane, Wash.* E D DEWHURST

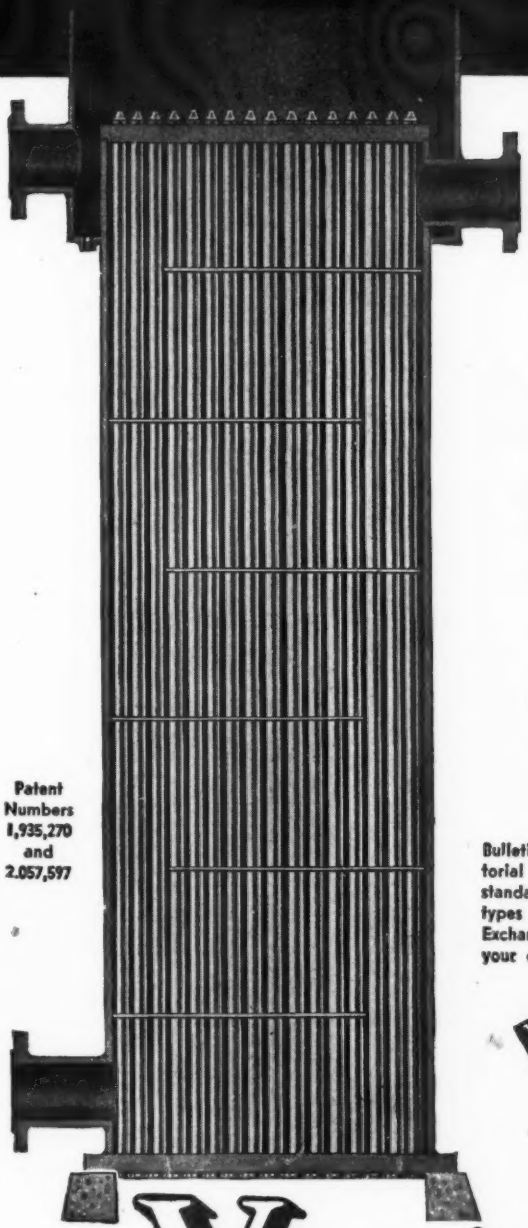
## Let Well Enough Alone

FROM MY KNOWLEDGE of a similar setup, city water would give *CB* more satisfaction and be cheaper.

A pumping plant requires two cen-

# FILM TYPE EXCHANGERS

DETAIL SHOWING DISTRIBUTING FERRULE IN TUBE (Patent Pending)



Patent Numbers 1,935,270 and 2,057,597

Vogt engineers have taken a familiar refrigeration plant "old timer" and developed it into this modern, efficient heat exchanger.

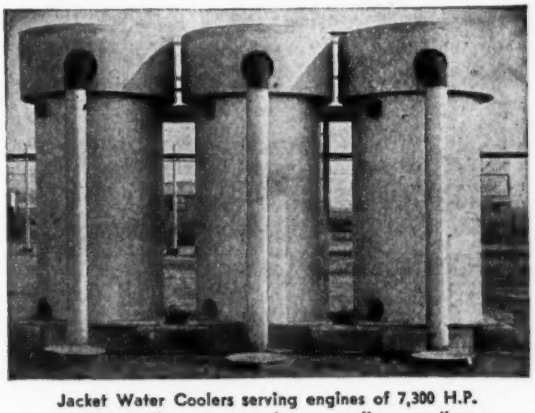
The film type exchanger operates in a vertical position. Water introduced in the top chamber is distributed in a thin film against the inner tube walls by means of special ferrules. The shell side of the exchanger has baffles arranged to provide optimum velocities, pressure drops, and heat transfer rates. Shutdowns are eliminated because tubes can be cleaned while the unit is in operation; thus permitting the use of dirty, mud and silt depositing water.

Vogt Film Type Exchangers now serve as Jacket Water Coolers, Sulphuric Acid Coolers, and Sulphur Dioxide Condensers, and can be designed to condense any vapor. They are also applicable for handling liquids other than water in film flow.

**HENRY VOGT MACHINE CO., INC.**
LOUISVILLE 10, KENTUCKY

Branch Offices: New York, Philadelphia, Cleveland, Chicago, St. Louis, Dallas

Bulletin HE-5 is a pictorial presentation of standard and special types of Vogt Heat Exchangers. Write for your copy.



Jacket Water Coolers serving engines of 7,300 H.P. Muddy well water used as cooling medium.

Vogt

# HEAT TRANSFER EQUIPMENT

# APPROVED

To the Industrial Engineer the characteristic of Stickle Equipment is *Dependability:* it does the job for which it is recommended. To the Plant Superintendent, Stickle Equipment is synonomous with *Smooth, Efficient Operation.* To the Production Manager, Stickle Equipment means *Quota at High Quality Level*—to the Plant Engineer, *Maintaining Steam Pressures with Less Firing.* To the General Manager, Stickle Equipment stands for *Production at Lower Cost.*

**Stickle Open Float Steam Traps APPROVED—**

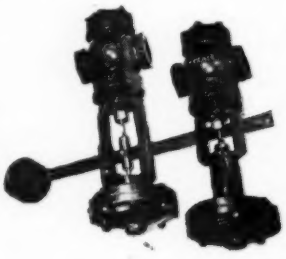
Approved for simplicity of construction, trouble-free operation, and long service life. Stickle Open Float, basic to entire Stickle line of traps, provides natural, positive action and frees units of all levers, hinges or other complicated internal mechanism. Large capacities in proportion to size. Air and gases eliminated with condensate.

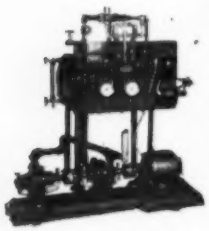
In series designs and sizes to meet requirements of specific operating conditions. Descriptive bulletins and engineering data on request. State application and working pressure.

**Stickle Regulating and Reducing Valves APPROVED—**

Stickle Valves are approved for complicated pressure regulation, being especially designed for use where pressure control within extremely close limits is essential. Sensitive, accurate—simple, compact. Easy to install. Renewable parts.

Self-contained valves in Single-seated, Balanced and Double-seated, Semi-balanced series, required sizes. Also Pilot-operated valves, Back-pressure valves and Float valves. Request descriptive bulletins with engineering data.





**Stickle Differential Drainage and Boiler Return Systems APPROVED—**

These systems are approved for plants operating steam processing units at medium to high pressures. They return condensate to boilers, under pressure, at temperatures only a few degrees lower than steam at operating temperature. Reduce steam costs, increase boiler capacity, and save pumping costs and boiler and steam line maintenance.

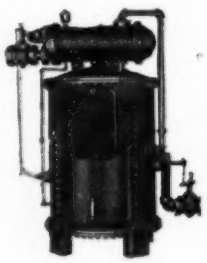
Systems built to meet operating requirements and conditions of specific plants. Advantages predetermined and guaranteed. Installed without interfering with plant operations. Ask for special bulletin.

**Stickle Open Coil Feed Water Heaters and Purifiers APPROVED—**

Approved for heating larger quantities of water to higher temperature in less space—delivering feed water to boilers at temperature within two degrees of saturated steam in heaters. Eliminate scale-forming substances and oxygen. One-sixth of total volume of boiler feed pure distilled water. Use exhaust steam for heating. Require little attention.

There is a Stickle Heater available for any industry. Capacities from 3,000-lb. single heaters to 250,000-lb. dual heaters.

Deaerating and Non-deaerating types. Cast iron or steel construction. Built standard or with extra storage space.



**STICKLE STEAM SPECIALTIES COMPANY**

**2265 VALLEY AVENUE · INDIANAPOLIS 18, INDIANA**

DRAINAGE AND CONTROL EQUIPMENT FOR PAPER MILLS, CANNING PLANTS, MILK DRYING PLANTS, TEXTILE MILLS, LAUNDRIES, AND OTHER INDUSTRIES USING STEAM FOR INDUSTRIAL PROCESSING OPERATIONS AND HEATING.


trifugal pumps, one 2½ in. and the other 2. Both pumps should be at the river, the larger one to do pumping and the smaller one to act as standby.

He will have to build 2000 ft of 3-in. pipe and power line. He should also have a storage tower at the plant. The pumps could be controlled by a float switch in this tower. With river water it is always necessary to contend with silt and sand. Someone would have to go to the pumphouse twice daily to check the pumps; this is essential to maintain good operation.

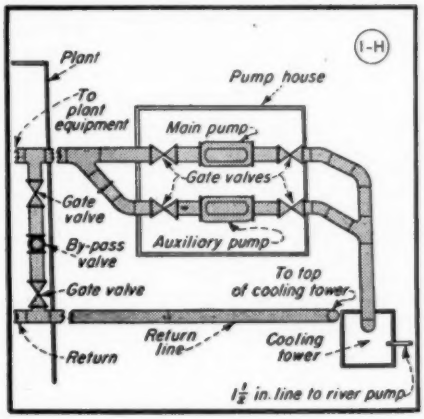
If *CB* has an unlimited supply of city water at the present price of $1.50 per 1000 cu ft, he should let well enough alone. It may cost a little more, but it's worth it.

*Vergennes, Vt.* R E WHITTY

## Use Cooling Tower And River Water

ALTHOUGH CB SAYS no storage is considered, I'm sure some storage space is necessary even though he pumps water direct from the river. During rainy seasons, water is probably so muddy that it is necessary to install a large settling plant.

By following the details of sketch 1-*H*, *CB* will have a good water system. Install a 50-gpm 1-hp centrifugal pump at or near the river, with pipe into




cooling-tower basin. Set water-level control to allow 1-ft variation in basin. Circulating system's suction line takes water from cooling-tower pond. It passes through main 125-gpm centrifugal pump into plant, then through various equipment, and back to cooling tower.

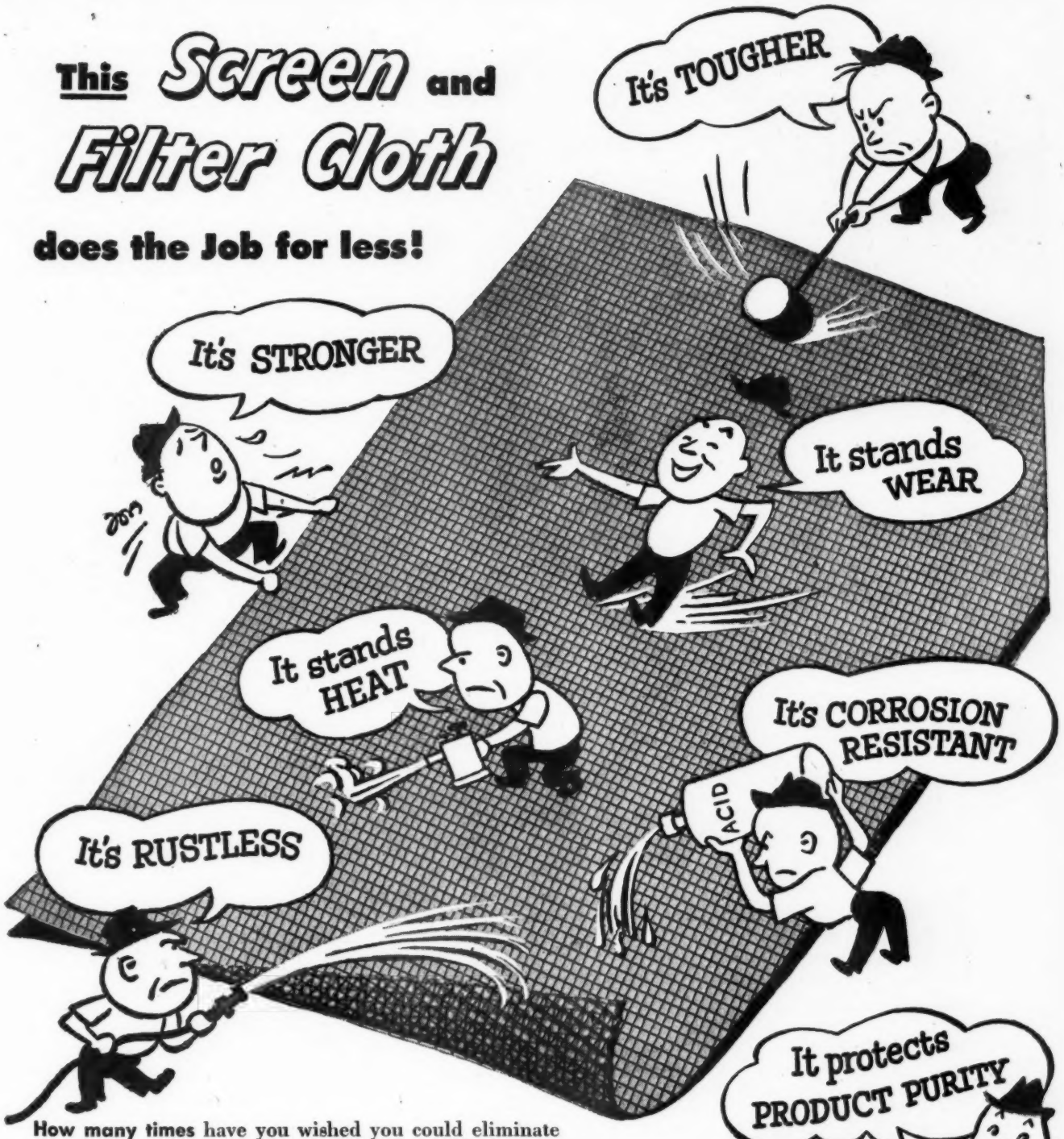
Install bypass with pressure-regulating valve, if all equipment is not in use.

*Quincy, Fla.* D J PARMER

## Sink Deepwell at Plant

CITY WATER at $1.50 per 1000 cu ft for 1,400,000 gal per month costs about

# This Screen and Filter Cloth does the Job for less!




**How many times** have you wished you could eliminate the shortcomings of ordinary fabric or metal cloth by using filters and screens made of Monel*, Nickel, or Inconel*.

Maybe you've thought they were too expensive to use in your equipment.

*Far from it!*

In many weaves, this cloth is *cheaper* than less durable metal. The low initial cost and longer service life actually can save you money.

Speak to your equipment manufacturer. Tell him you want the extra protection of the "task metals" in your filters and screens.

All weaves and meshes are available from regular wire weavers.

*Reg. U. S. Pat. Off.

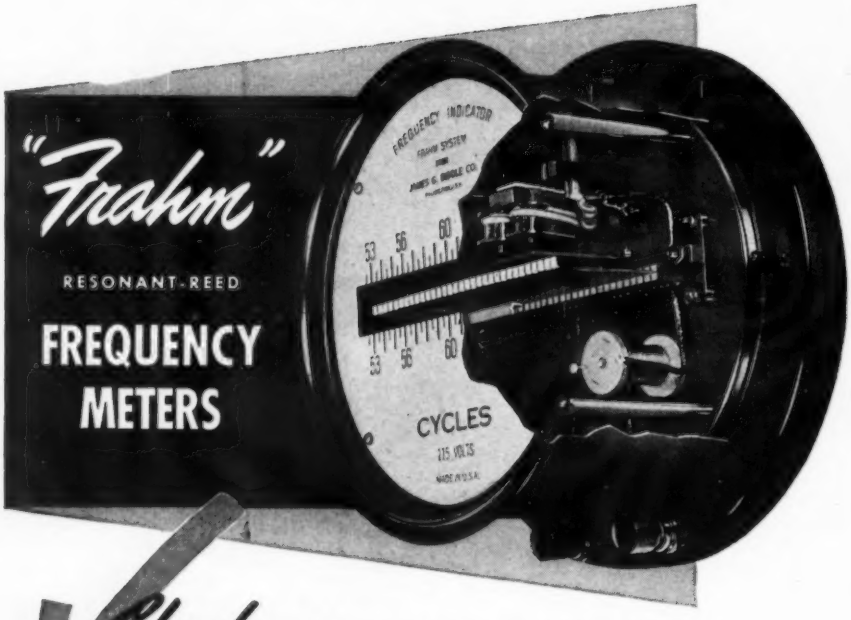
Send for our booklet: "ESTABLISHED WEAVERS OF MONEL, NICKEL AND INCONEL WIRE AND FILTER CLOTH."

**THE INTERNATIONAL NICKEL COMPANY, INC.**
**67 Wall Street, New York 5, N. Y.**

INCO TRADE MARK

**Monel* Nickel Inconel***

**"TASK METALS" FOR INDUSTRY**




## Check THESE ADVANTAGES

- **ACCURATE,** because the tuned reed is a natural resonant indicator.
- **DEPENDABLE,** because permanent calibration is a natural characteristic of tuned reeds.
- **STURDY,** because there are no delicate pivots, jewels or moving parts.

*and these . . .*

**EASY-TO-READ** vibrating reed-tips form a clearly defined pattern.

**LITTLE MAINTENANCE** is a result of simple, sturdy construction.

**LOW INPUT** power is sufficient to actuate the reed comb.

**OPERATE IN ANY POSITION** without affecting accuracy.

**NO WAVE FORM-ERRORS** because resonance is a function of the driving frequency only.

**INPUT VOLTAGE IS NOT CRITICAL** since accuracy is independent of supply voltage.

**UNAFFECTED BY EXTERNAL FIELDS** as damping effect on natural reed frequencies is negligible.

**ORDINARY ROOM TEMPERATURE VARIATIONS HAVE LITTLE EFFECT** on calibration.

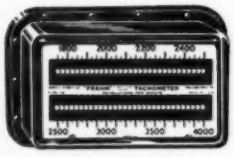
**INDEPENDENT OF LOAD, POWER FACTOR OR PHASE SHIFTS** on supply circuit.

**APPLICABLE TO PULSATING OR INTERRUPTED DIRECT CURRENT** as well as to alternating current supply circuits.

Frahm Frequency Meters in switchboard, miniature and portable types are available in various ranges between 15 and 500 cycles per second . . . special requirements up to 1500 cps will be considered. Write today for illustrated Bulletin 1770-P.

**"FRAHM" Resonant-Reed TACHOMETERS**

. . . operate on the same unique principle as Frahm Frequency Meters except that reed vibration is produced by direct mechanical contact instead of electrically. Available in stationary and portable types . . . for use on turbines, generators, motors, blowers, centrifugal pumps, diesel-electric installations, etc. Various ranges from 900 up to 100,000 rpm. Write for Bulletin 1810-P.



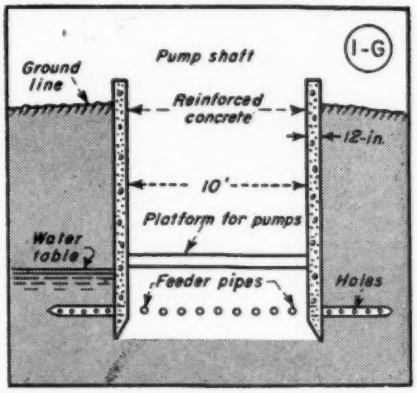
James G. **BIDDLE CO.**

ELECTRICAL & SCIENTIFIC INSTRUMENTS

1316 ARCH STREET • PHILADELPHIA 7, PENNA.


$280. Plant operation 22 days per month, or 176 hr, at 140 gpm, gives 1,478,400 gal. Power to pump total head of 30 ft plus plant service pressure would use 173-ft total head. A 15-hp motor and pump of 150-gpm capacity at 160-ft head would require about 5.65 hp ÷ 65% efficiency = 8.7 hp, or 6.5 kw. Using 3c per kwhr, power would cost $0.20 per hr for 176 hr, or $35.20 per month.

Swampy ground with gravel underlay indicates plenty of water flows under the plant. Therefore, I suggest a deepwell shaft to water table. Locate the shaft away from plant, say 30 ft; sink a timber, steel or concrete-lined shaft at least 10 ft inside diameter. Drive out seep pipes as in 1-*G*. Install pump near water line as shown, or use




a deep-well pump, having motor at surface. Automatic controls can be provided, pressure or time operated, or both. Thus, the pumps would require weekly attention only. A deepwell properly constructed will not give intake or freezing trouble and the entire project will be on plant property.

HAMMOND MATHEWS

*Silverton, Colorado*

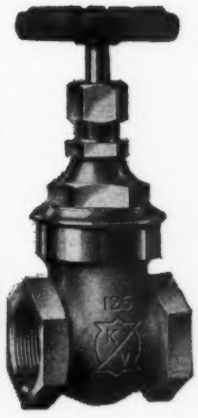
## Seek Advice on Underground Water

WATER COST of $1.50 per 1000 cu ft is not excessive. I doubt if *CB* can pump, treat and store river water, add power, supervision and maintenance costs, and come out ahead on such a small volume.

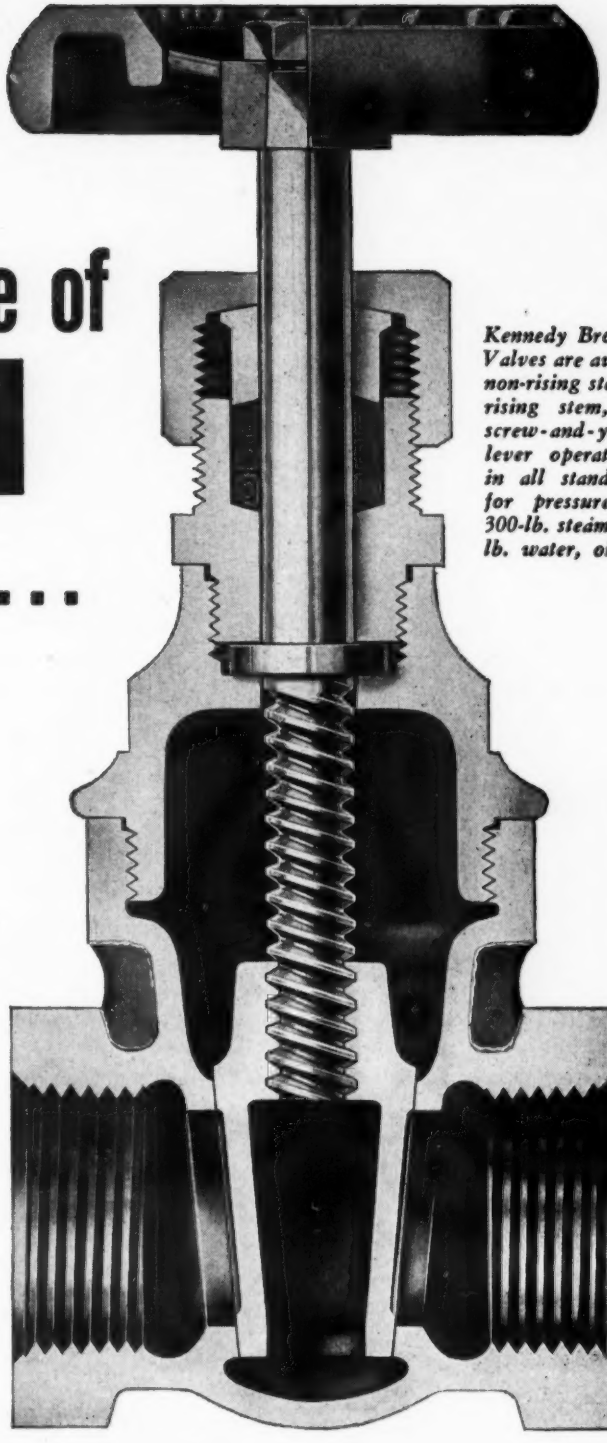
The city-water meter now in service provides an excellent setup for determining maximum hourly demand for water. Next, he needs to know what pressure gives the required volume of flow at each water-consuming device. There may be 200 psi in the city mains, which may have prompted some small piping in the plant.

Assume that 1,400,000 gal are used in 20 working days, or 70,000 gal per day. If that volume is to be pumped

# This... on the outside



# is your assurance of lasting service on the inside .....



*Kennedy Bronze Gate Valves are available in non-rising stem, inside rising stem, outside-screw-and-yoke, and lever operated types, in all standard sizes for pressures up to 300-lb. steam and 600-lb. water, oil or gas.*

It's no secret—Kennedy Valves give long, trouble-free service because every part is designed for maximum life. Take this bronze gate valve, for instance. Note the large bonnet hexes close to the body. That prevents body distortion. See the large number of heavily proportioned stem threads . . . the simple, strong, accurately guided disc.

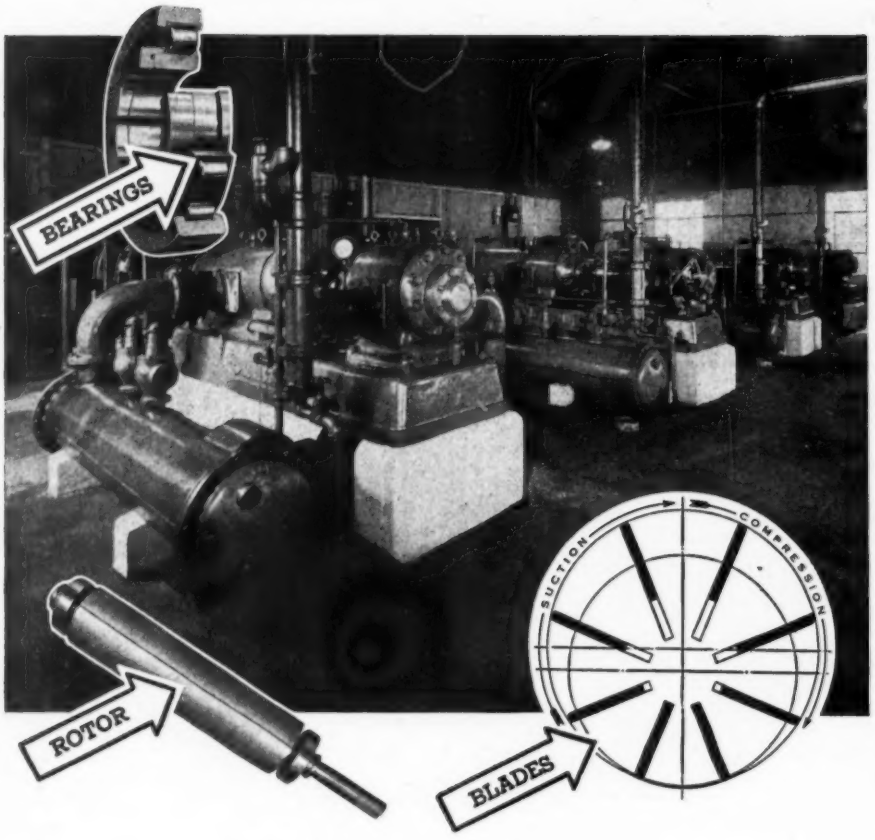
Look at *any* valve that has Kennedy on the outside. You'll find an abundance of long life features . . . all of them fully described in Kennedy's 240-page Catalog, along with complete information on Kennedy bronze and iron-body gate, globe, angle and check valves, pipe fittings and flanges, and other valves and accessories. Write for your copy today.

**BUY FROM YOUR LOCAL DISTRIBUTOR**

KV-148

# KENNEDY valves-pipe fittings-fire hydrants

**THE KENNEDY VALVE MFG. CO., ELMIRA, NEW YORK** *Offices and Warehouses in Principal Cities*




# Fewer Working Parts to Wear . . . None to Adjust

**The fewer working or moving parts that make up any piece of equipment, the more continuous the service at lowest operating cost.**

**Fuller Rotary Compressors and Vacuum Pumps are an outstanding example of simplicity of design and construction . . . the only moving parts: rotor—bearings—blades.**

**Simple design, rugged construction for long, continuous service, that's what you get when you purchase a Fuller Rotary. There are no periodical adjustments or take-up and, due to design and construction, *original capacities are maintained for the life of the machine.* This simplicity of design also allows inspection and repairs to be made with minimum loss of time and at minimum expense.**

**Fuller Rotaries are the ideal units to install for capacities up to 3300 c. f. m., 125-lb pressure. We invite your investigation and inquiries. We'll be glad to send you Bulletin C-5, which fully describes and illustrates these machines. Send for your copy today.**

**FULLER COMPANY, CATASAUQUA, PA.**

**Chicago 3 - 120 So. LaSalle St.**
**San Francisco 4 - 421 Chancery Bldg.**

C-152

FULLER

A LIFETIME OF NEW MACHINE EFFICIENCY

in an 8-hr work day, he requires a pump of 146 gpm capacity. If the pump is 2000 feet away, at the river, pipe size should most likely be six inch. He will need two pumps of the full capacity.

*CB* indicated preference for a direct-pressure system without storage. Draining back all the piping when the pump is down is objectionable because corrosion is stirred up in the pipes. If he expects to turn city water into the system at this time, he runs afoul of most city and state laws prohibiting cross connections between safe and unsafe water supplies.

*CB* cites only river water as an alternative to city water. From his description conditions seem favorable for a good underground water supply from a dug or drilled well. Since the chief use of water is for cooling, well water would have a distinct advantage because of lower temperature.

Let us consider pumping river water. It requires preliminary screening before being handled by pumps, and further treatment, usually chlorination, to make it safe for most plant purposes. This calls for a building of considerable cost and constant supervision.

There are legal and structural difficulties in getting pipe and power lines under railroad right of ways. The entire line should be accessible to repair without red-tape preliminaries.

Consult city and county engineers and the state geologist to get all information on underground waters. Then get the advice of drilling contractors who have been successful with wells.

*Aspinwall, Pa.* J A GRAHAM

### READER'S PROBLEM ANSWERS TO QUESTION 2

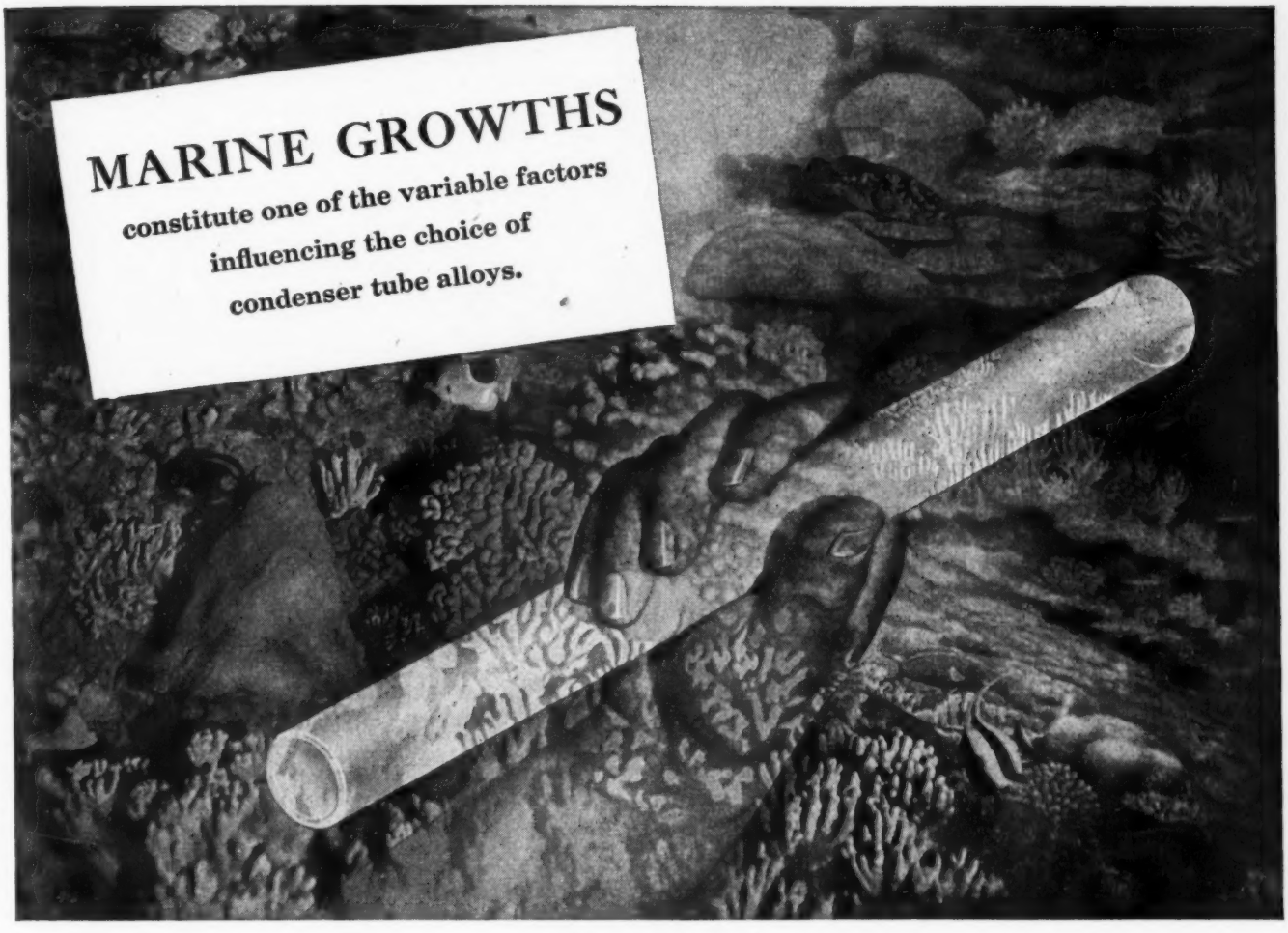
*(Continud from page 117)*

equipment, consider the following points first:

(1) Size and operating voltage of the particular device, which is secondary compared to the relative importance of its function in the manufacturing process. The size and cost of the device does, however, become important when considering cost of repairs.

(2) Since insulation resistance of electrical equipment is greatly affected by surface conditions, particularly of dc rotating equipment, it becomes a measure of cleanliness. Measurement of insulation resistance is important because good housekeeping pays dividends. Frequency of making tests depends on the extent to which equipment is subjected to dirt, moisture and other contaminants.

(3) Insulation-resistance measurements reveal insulation deterioration




Marine growths, not encountered in many heat exchanger installations, can present a problem warranting major consideration in others. One of the most serious consequences resulting from the presence of certain types of marine life is the "concentration cell" established when these organisms attach themselves to and cover a portion of the tube metal, leaving adjacent areas bare. Electro-chemical action between the shielded and unshielded areas ensues, resulting in rapid corrosion adjacent to the line of contact of these areas. Concentration cell action from such causes is often termed "deposit attack".

The presence or absence of marine growths, however, does not, by itself, establish the tube life to be expected in any installation. Other factors which must be considered include:

**Velocity and turbulence of coolant . . . Abrasives suspended in coolant . . . Dissolved or entrained air or gases . . . Temperatures inside and outside of tubes . . . Deposits other than marine growths . . . Development of protective film . . . Media surrounding tubes . . . Chemical composition of coolant.**

One of the principal objects of Condenser Tube Technical Research has been the development of alloys designed to give longest life and most trouble-free service. Proper alloy selection, however, is often not a complete and sufficient answer when marine growths are a serious problem. Many times it is also necessary to employ frequent normal cleanings and or chemical treatments such as chlorination in suitable concentrations under the supervision of trained and experienced personnel in order to obtain satisfactory service life from even the best tube alloy available.

Because of the number and variety of conditions surrounding any particular condenser tube installation, each such installation becomes an individual problem, deserving of individual treatment.

Scovill has made, or is making, extensive studies of Condenser Tube Service conditions for every known application, and offers the facilities of its Technical Service Department in the selection of suitable Condenser Tube alloys to meet specific service conditions, in an existing or proposed installation.

**THREE SCOVILL SERVICES**

Scovill's *Service in Men* offers specialized consultation on individual tube application problems and suggestions regarding alloy selection and tube installation practice. *Service in Metals* includes development and production of a broad range of tube alloys under laboratory control, which verifies that Scovill alloys conform to requirements of specifications. *Service in Manuals* consists of literature providing the latest, most authentic information on condenser and heat exchanger tubes, which has its source in the broad experience of our engineers and the findings of our laboratories.

For a copy of the *Condenser Tube Booklet*, address Scovill Manufacturing Company, 13 Mill Street, Waterbury 91, Conn. *Export Department:* 405 Lexington Ave., New York 17, N. Y.

SCOVILL

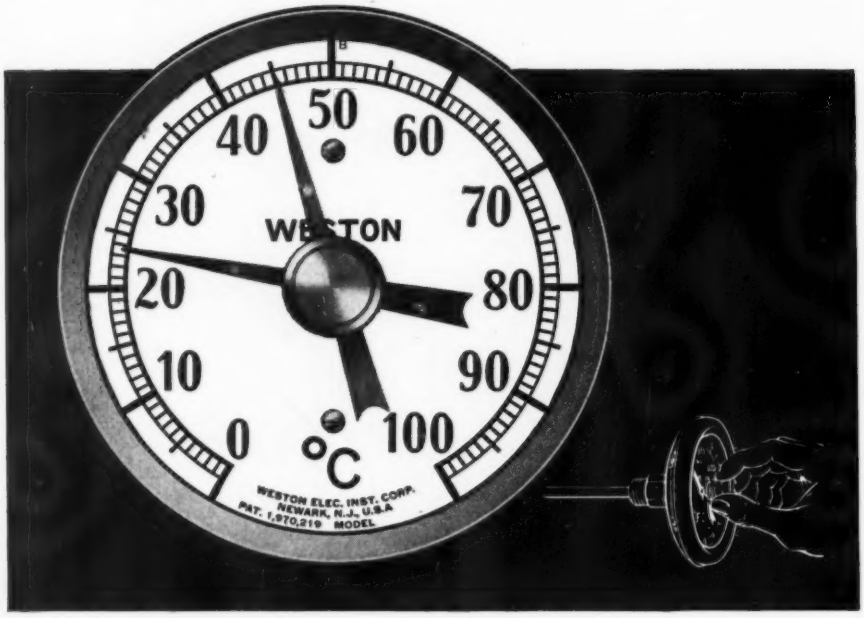
# SCOVILL

## CONDENSER TUBES

**One Product • Three Services**

***Service in Manuals . Service in Metals . Service in Men***

# THE THERMOMETER THAT *REMEMBERS!*




# WESTON

## *all metal*

## MAX-MIN* THERMOMETER

**What's the present temperature of that transformer oil?**

**What was the highest temperature reached since last reading?**

You want the answers to both these questions—and the MAX-MIN gives them . . . accurately!

The red index pointer on the MAX-MIN is manually set to either the low or high side of the main indicating pointer. When set on the high side, for example, it moves as the temperature increases, always remaining at the extreme temperature reached, until manually re-set. Thus one quick reading gives both *present* temperature and the *peak* temperature since last reading.

For complete details see your jobber or local Weston representative. Weston Electrical Instrument Corporation, 679 Frelinghuysen Avenue, Newark 5, New Jersey.

*Registered Trade Mark

WESTON *Instruments*


aside from surface conditions; therefore, reconditioning practices in the plant have a bearing on the frequency of making insulation-resistance tests.

(4) Other defects or abnormal conditions are often found in making periodic insulation-resistance tests.

(5) Economics of the tests must be considered, that is, cost of tests have to be balanced with tangible and intangible costs of failures.

The following intervals for making insulation-resistance tests of equipment are good practice:

| *Equipment* | *Number of months* Min | Max | Average |
|---|---|---|---|
| Motors and motor control | 1 | 12 | 6 |
| Circuits in conduit | 6 | 24 | 12 |
| Outdoor, oil-filled transformers | 6 | 24 | 12 |
| Outdoor, high-voltage oil circuit-breaker bushings | 6 | 24 | 12 |

Establishing minimum values of insulation resistance for a particular plant and specific apparatus is impracticable. A marked change in the normal value of insulation resistance is more significant than any one value.

*Philadelphia, Pa.* E B CURDTS

## Conditions Govern Insulation Tests

FREQUENCY OF INSULATION CHECKS should be governed by conditions under which equipment operates rather than by a set rule. I suggest that *RG* check all new equipment before putting it in service, and also equipment that has been idle any length of time. Equipment in service may be checked at 6-month intervals. He may have some motors operating, however, that he considers less dependable; these should be checked oftener.

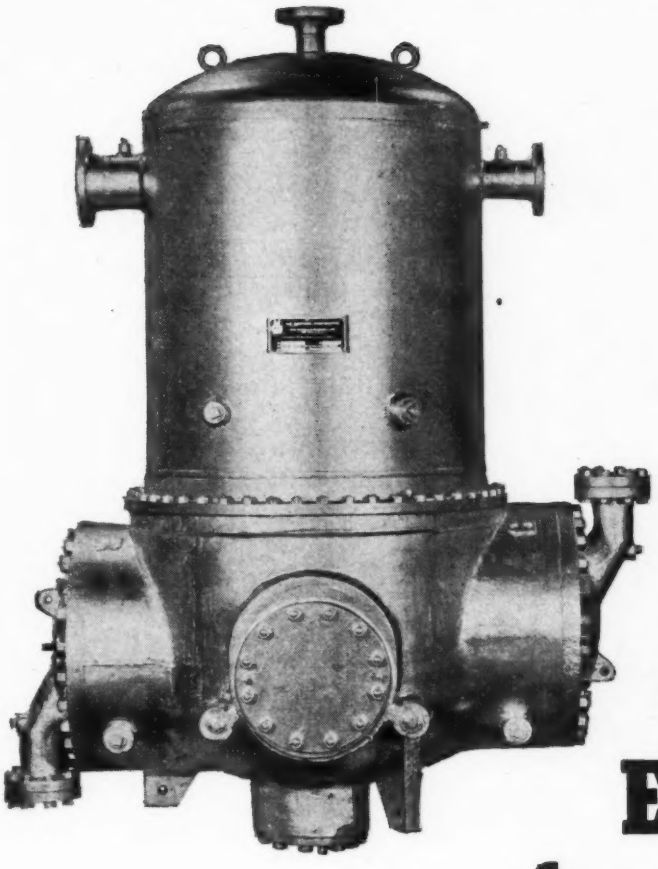
Insulation resistance that is satisfactory or readily attainable in one plant may be entirely too high to attain in another; for example, a coal mine or chemical plant as compared to a well-maintained office building.

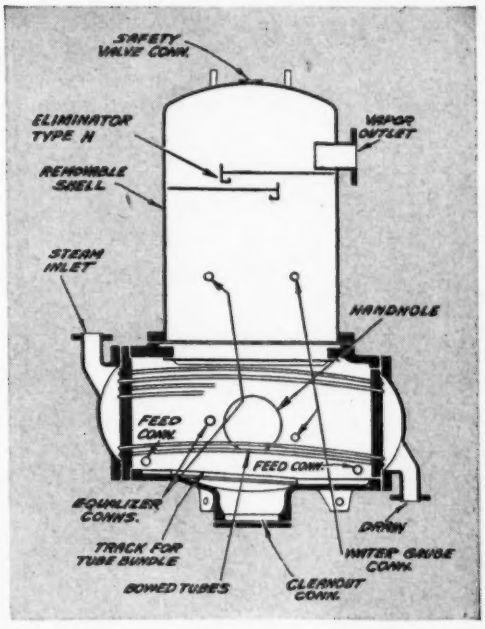
As set by AIEE, minimum values of insulation resistance of a machine at its operating temperature should be not less than that given by the formula. Insulation resistance in megohms =

$$\frac{\text{Rated voltage}}{\frac{\text{Rating in kva}}{100} + 1000}$$

We find that these minimum values are very low. Therefore, with motors and equipment, as well as with circuits, it is well to keep a record of insulation-resistance condition and date these checks are made. Then, at a later check, if the values are materially less, look for trouble, because with good conditions each check should be uniform.

*Cleveland, Ohio* K W SCOTT





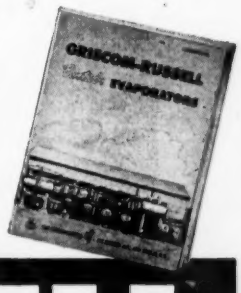

# Here is your EVAPORATOR for small capacities and low pressures

## *Note These Distinctive Design Features of G-R Type H Bentube Evaporators*

- Bentube elements crack off scale by "thermal shock" on changes of temperature and without requiring hand-scaling
- Each individual tube is free to expand and contract independently of others
- Low tube bundle and exceptionally high dome provide large vapor space to insure purity of the vapor produced
- The multiple short tubes assure lowest possible steam pressure drop
- All connections are external to the shell, and there are no bolted joints or piping inside the shell, thereby providing greatest simplicity and convenience
- The tube bundles are readily removable without entering the shell
- Tubes are sloped to be self-draining, and are widely spaced to prevent bridging of scale and to allow free dropping of scale to the bottom of the shell
- The design is adapted to installations where floor space is limited

Out of the Griscom-Russell 78 years of experience in building heat transfer apparatus has come the Type H Vertical Bentube Evaporator . . . specially designed to produce pure distilled boiler feed make-up for the moderate size plant.

The many distinctive features of these units have long proven their advantages in the large high-pressure G-R Bentube Evaporators of which the Type H is an adaptation. These features, some of which are listed in the table, have made G-R Evaporators widely preferred in central power generating stations, modern industrial plants and on shipboard, with installations serving a total of more than 40,000,000 boiler horsepower



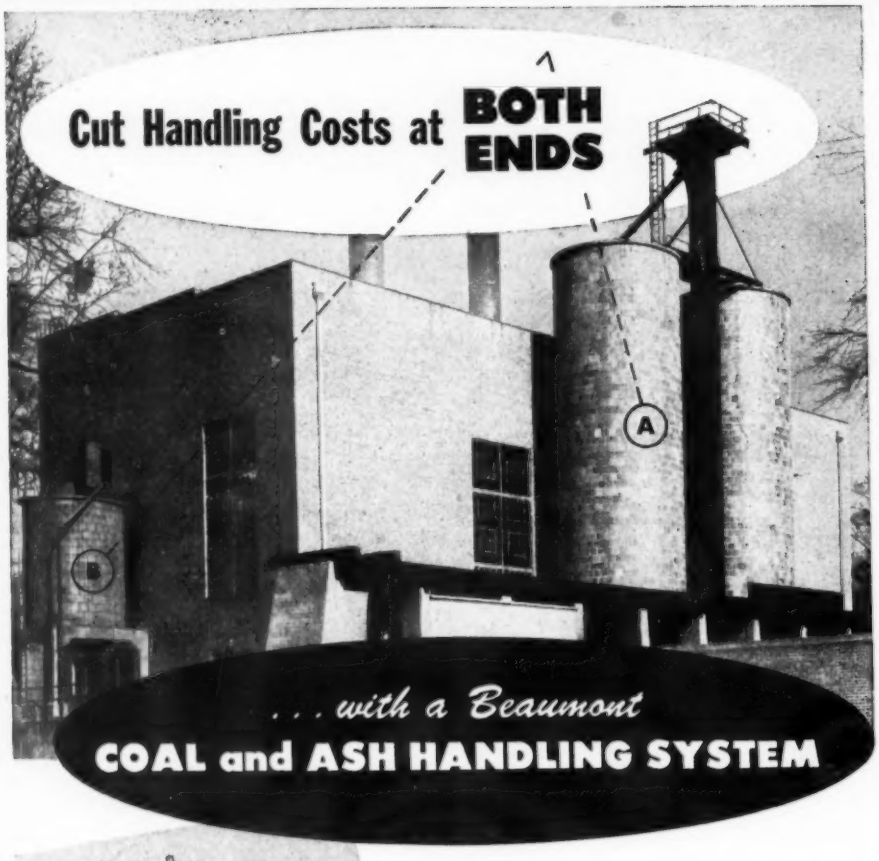

Write for Bulletin 364 describing the advantages and applications of G-R Bentube Evaporators in detail.

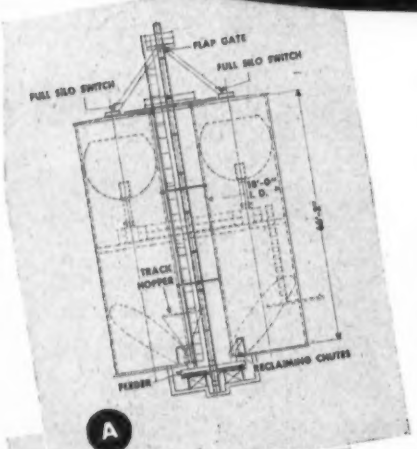
**THE GRISCOM-RUSSELL CO.**
**285 Madison Avenue, New York 17, N. Y.**

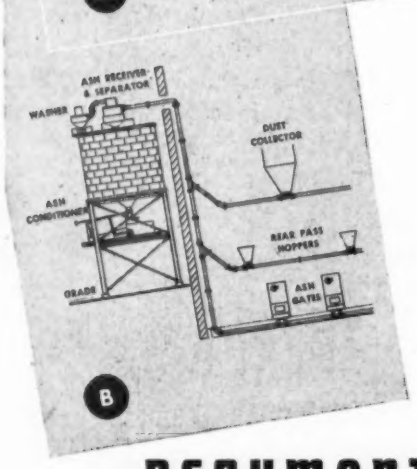
GR-180

# GRISCOM-RUSSELL

*Pioneers in Heat Transfer Apparatus*




**COAL HANDLING**

With Beaumont Birch Coal Handling Equipment, one operator controls all coal from the time it arrives by rail and is dumped in the track hopper, through its lifting by bucket elevator, to its use —immediate or future.

**ASH REMOVAL**

The Beaumont "Vac-Veyor" system offers the most direct and economical method for removal of ashes, siftings, soot and dust. They are vacuum conveyed through a pipe from their source to an ash receiver and separator—then into the silo where they remain until final disposal.

Beaumont engineers design and erect this equipment—a complete coal and ash handling system. This brings you savings in installation as well as in handling costs—you have one contract, we have sole responsibility.

*Write for more information to:*

**BEAUMONT BIRCH** *Company*

1502 RACE STREET—PHILADELPHIA 2, PENNA.

*Designers* *Manufacturers* *Erectors* BULK MATERIAL HANDLING SYSTEM


## New Equipment

(*Continued from page* 144)

erator protection. Current carrying capacity is 30 amp. Binding post is complete with all components ready for mounting on any panel up to ¼ in. thick. **Dept P, Superior Electric Co, 425 Church St, Bristol, Conn.**

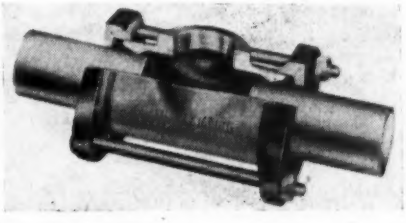
### Welding Electrode

AIRCO No. 375 ELECTRODE has a high-nickel core wire and a heavy extruded coating that makes it applicable on cast iron.

Because of its high nickel content, electrode flows well and the resultant deposit is sound. Weld and fusion zone is soft and easy to machine. New electrode may serve on ac or dc, and is available in 5/32 and ⅛-in. diameters. **Dept P, Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y.**

### Cutting Torch

AIRCO SERIES 9000 CUTTING TORCH with Monel metal head and stainless-steel tubes is again available. All connections are silver brazed to assure permanent leakproof service. A total of 22 interchangeable cutting tips are available for the torch, making it adaptable for practical hand-cutting operations from removing rivet heads to cutting sheet metal and trimming plates. Standard torch is 21 in. long and weighs 3 lb. 4 oz. Straight or angle heads are available. **Dept P, Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y.**



### Pipe Coupling

FLEXIBLE T-COUPLING connects laterals to existing pipelines without need for field threading. Device is available for 2-in. cast-iron standard and OD pipe and for other sizes as small as ¾ in. Each outlet is same nominal size as the pipe run, but has standard threads that permit use of bushings where needed. **Dept P, Smith-Blair Co, South San Francisco, Calif.**

### Neon-Glow Voltmeter

A SIMPLE METER of practical accuracy, *Mini-Volt* is especially adapted for repair and maintenance men, electricians, radio service men, experimenters and laboratory workers. It is virtually burnoutproof and is immune to mechanical and electrical abuse. Housed in a neat *bakelite* case

SAFE · DEPENDABLE · PRECISION OPERATION · 40 YEARS EXPERIENCE
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- ☐ Relief-Regulating Valves, Water
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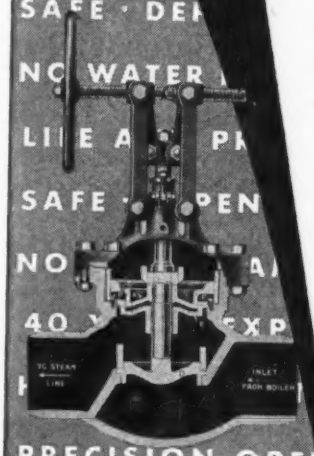
***Check the Type of Valves you need and mail to Golden-Anderson for complete information.***



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***VALVE* Specialty Company**
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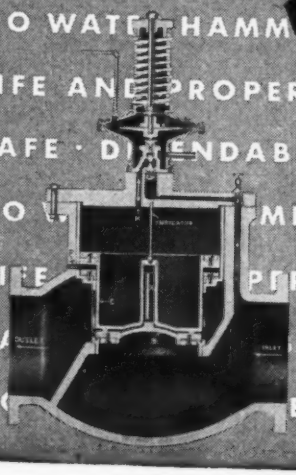

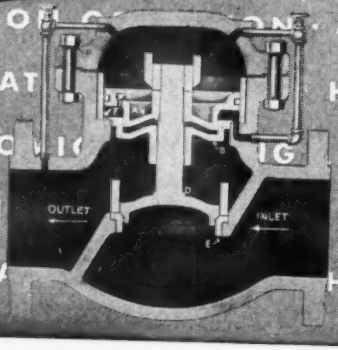


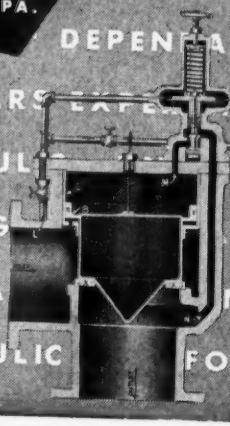

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For a limited time only, we will ship an ALLPAX Gasket Cutter for a 30-day trial at our expense. Write for details of this offer.

Made by a packing manufacturer who knows the needs of packing users. This fast, convenient tool will save you time, money and material over the slow laborious sloppy method of cutting gaskets by hand. Gasket cutting is put on a production basis by the "ALLPAX". Cuts clean gaskets in any gasket material in diameters from 1" to 36", with any width flange. Pays for itself and effects savings every time it's used.

Complete . . . ready to use . . . packed in hardwood case with hinged cover. Equipment includes six (6) double-edge cutting blades and one (1) 18" varnished wood cutting board. Order NOW.

**PRICE COMPLETE $19.50**

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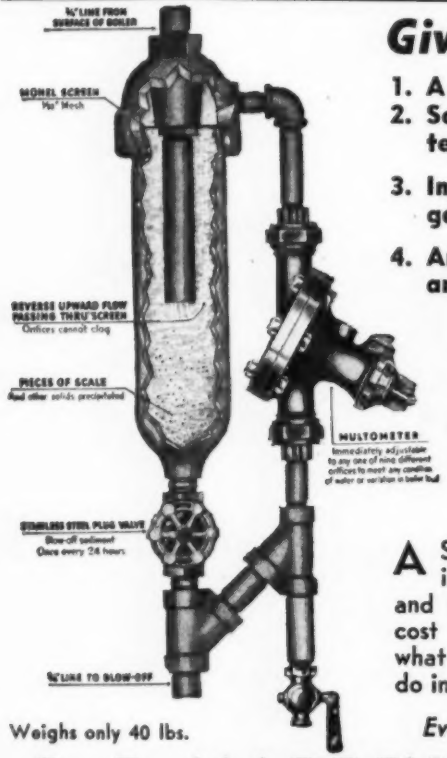
**MULTOMETER SYSTEM** CONTINUOUS BOILER BLOW-OFF

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*Gives You - -*

1. A reduction in your fuel costs
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3. Increased efficiency of steam generation
4. An end to wet steam, foaming, and priming
5. Continuous removal of impurities and sludge as accumulated
6. Boiler concentration and chemical balance maintained as desired

*— and other benefits*

A SURVEY of your operation, including analyses of both feed water and boiler water, is available without cost or obligation. Let us show you what the MULTOMETER SYSTEM can do in your plant.

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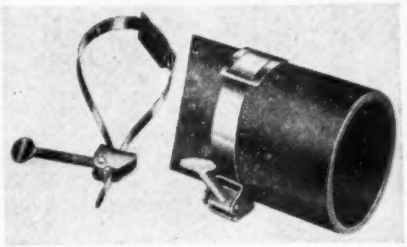
and provided with 12-in. flexible test leads with prongs, it is rugged enough to be thrown into toolbox or carried in the pocket without danger of damage. Calibrated for use on ac from 65 to 660 v, with an impedance of about one-half megohm, it operates by turning knob until *Neon* glow extinguishes, whereupon voltage is read directly on scale. For dc, which is indicated when only one electrode of the *Neon* indicator glows, reading on the dial is multiplied by 1.15.

This handy instrument checks whether lines are 110-220 v, etc. It may also serve to indicate blown fuses and check overloaded lines by taking readings at various points with load turned on. **Dept P, Industrial Devices, Inc, Edgewater, N. J.**

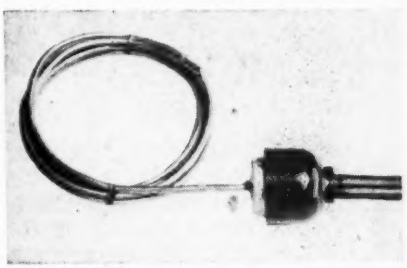


## Pipe Clamp

PATCHMASTER STOPS LEAKS on low- or high-pressure pipe ½ to 4 in. in dia. Clamp consists of a corrosion resistant, stainless-steel universal clamp, patch plate of stainless steel, and a *Hycar* oil-resistant pad. *Patchmaster* has been tested at 800 psi without leaking. They come in four sizes to handle all pipe diameters up to 4 in., and can be used repeatedly. Another series serves for pipes up to 8 in. and pressures to 1100 psi. **Dept P, Marman Products Co, 940 W Redondo Blvd, Inglewood, Calif.**

## Electrical Symbols

ELECTROMASTER No. 175 provides a convenient guide for drawing electrical symbols. Made from quality plastic sheets, this guide makes every electric symbol shown in the *American Standards Association Manual*, as well as other accepted symbols. Inner contours are beveled for easy tracing. Printing is between laminated sheets and cannot wear off. **Dept P, Rapidesign, Box 592, Glendale, Calif.**



## Freezer Alarm Switch

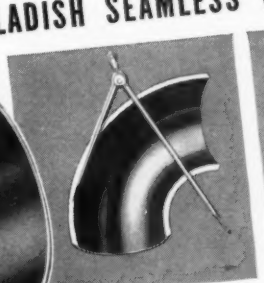
DESIGNED TO warn of dangerous temperature rises in remotely located freezers, or indicate mechanical difficulty, this alarm switch is installed with either a bell, light

(*Continued on page* 176)

# *Metallurgical Integrity* Protects your piping when you install Ladish Seamless Welding Fittings

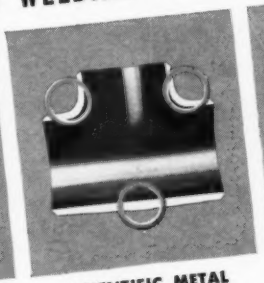
**Rigid metallurgical controls . . . made effective by one of industry's most modern and completely equipped laboratories . . . assure users of Ladish Seamless Welding Fittings a full measure of dependability. Exhaustive physical and chemical tests insure metal properties that best provide long, trouble-free service. This Ladish metallurgical integrity . . . evidenced by the heat code identification on each Ladish fitting . . . gives added protection to your piping installations.**

## LADISH SEAMLESS WELDING FITTINGS GIVE YOU THESE ADVANTAGES



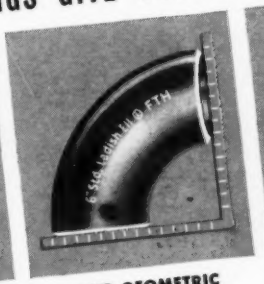
**FULL EFFECTIVE RADIUS**

Reduces friction and pressure loss to a minimum and decreases turbulence.



**SCIENTIFIC METAL DISTRIBUTION**

Permits designs of maximum mechanical strength to resist piping strains.



**TRUE GEOMETRIC ACCURACY**

Facilitates piping makeup, assures accurate alignment and flow efficiency.

**SMOOTH INNER SURFACES**

Minimize resistance to flow. Absence of irregularities retards erosion.

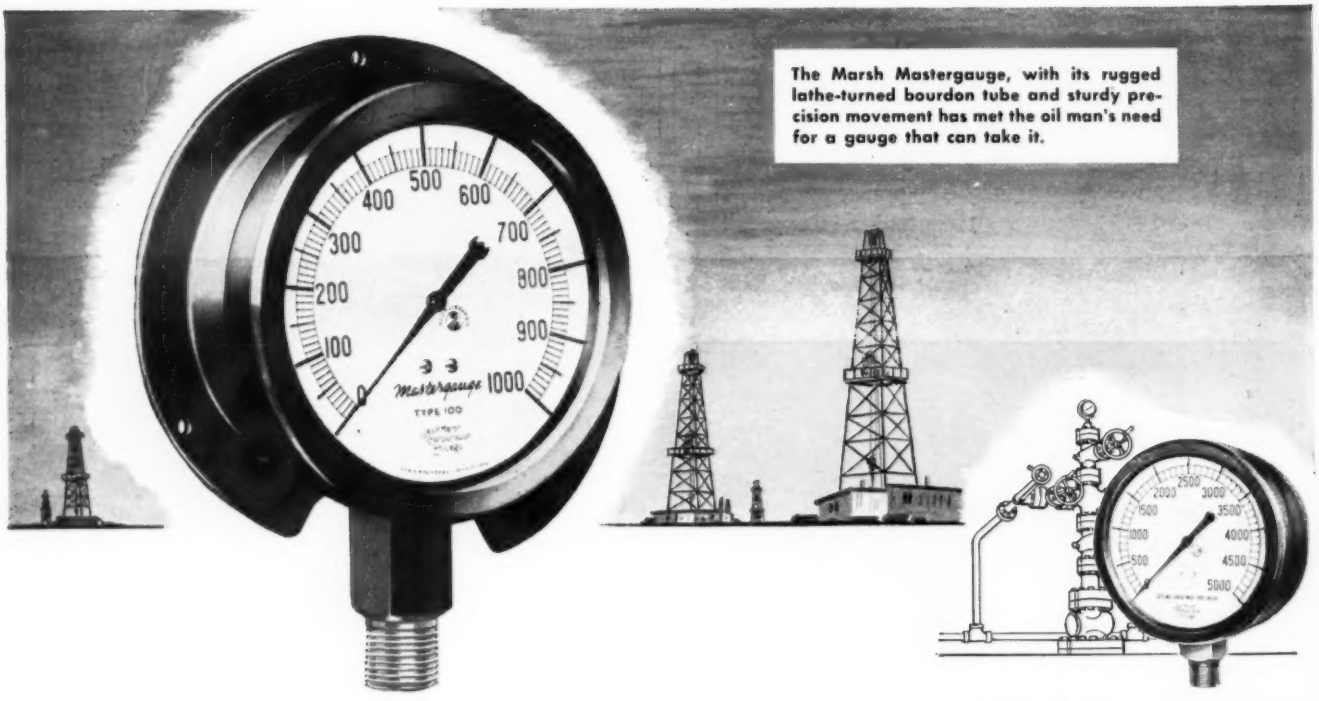
TO MARK PROGRESS

*Controlled Quality* FITTINGS

**LADISH CO.**

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

DISTRICT OFFICES:
New York • Buffalo • Pittsburgh • Cleveland • Chicago • St. Louis • Atlanta • Houston • Los Angeles




The Marsh Mastergauge, with its rugged lathe-turned bourdon tube and sturdy precision movement has met the oil man's need for a gauge that can take it.



Oil men call these tree-like piping assemblies "Christmas trees." Marsh "Christmas Tree" Gauges are widely used for this service—some of them on the highest pressure oil well in the world.

# Throughout the oil country

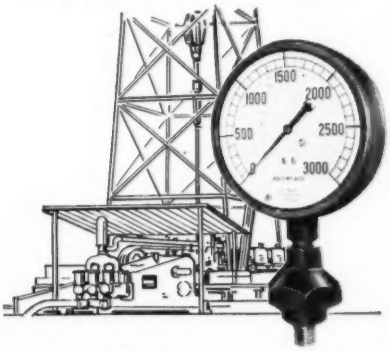
# *Marsh is the gauge!*

When you run across a particularly tough problem of pressure measurement in any branch of industry, it's a pretty safe bet you'll find a Marsh Pressure Gauge in full charge of the situation. And there is no better place to see this than in the production phase of the petroleum industry.

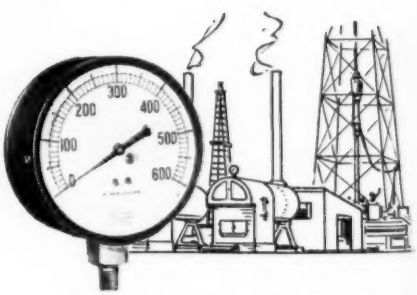
Out in the oil country you find every kind of punishment a pressure gauge can be asked to undergo. Sometimes it's extreme pressure; sometimes, extreme temperature; sometimes, racking vibration or relentless pulsation; often, all of these at once. In dealing with such conditions, oil men have become about the toughest critics of pressure gauges; so the preference they have shown for Marsh instruments is a remarkable tribute to Marsh accuracy and stamina.

Yes, Marsh is the oil country's own gauge—first choice of a great field where precision and ruggedness is a law unto itself. Yet this is only one example of the preference shown in many fields by men who know pressure gauges forward and backward.*

Keep this in mind when you select pressure gauges. Why accept less than the instruments preferred by the most critical of pressure gauge users?



The Marsh Mud Pump Gauge, popular in the oil country, is an excellent example of Marsh specialization.



Marsh is the gauge on the familiar oil country boilers.

**JAS. P. MARSH CORPORATION, 2025 Southport Ave., Chicago 14, Illinois**
***Export Dept.: 155 E. 44th St., New York 17, N. Y.***

*Jas. P. Marsh products include:* **A full line and range of gauges in pressure, vacuum compound, altitude, hydraulic, sprinkler, ammonia, ounce-graduated retard, test, and diaphragm types. Dial thermometers in rigid stem and remote reading types. A broad line of steam and hot water heating specialties. Ask for literature.**

# MARSH GAUGES

"THE STANDARD OF ACCURACY"

**Marsh alone has the "Recalibrator"**
—quickest and best way to correct a gauge that has been knocked out of adjustment by improper handling.

* One of a series of advertisements citing examples of this.

# BEARING DOWN ON ACCURACY

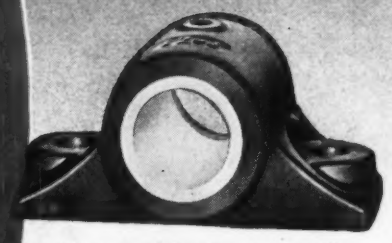
## BABBITTED BEARINGS

**for Shaft Sizes 5/8" to 6"**

**Running true to form, Jeffrey makes Babbitted Bearings to a high degree of accuracy:**

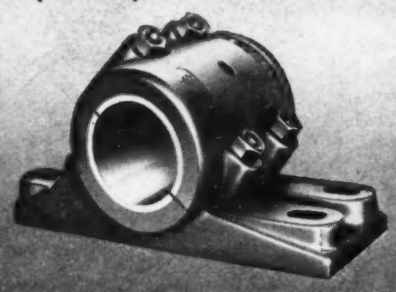
- **Caps and bases are accurately ground before babbitting . . . caps are drilled and tapped for grease cups or high pressure fittings**
- **Bores are broached and the ends of bearings faced with caps bolted in place, assuring perfect alignment and fit.**
- **Hard fibre shims between caps and bases of split bearings provide adjustment for wear.**
- **Groove in cap provides ample grease storage . . . grooves at the split properly distribute grease over entire length of bearing surface.**

**These Jeffrey bearings are packaged individually in sealed cartons to protect them during shipment, handling and stocking. Just as important for you to get more data about these Jeffrey Precision-Built Bearings. Write today.**

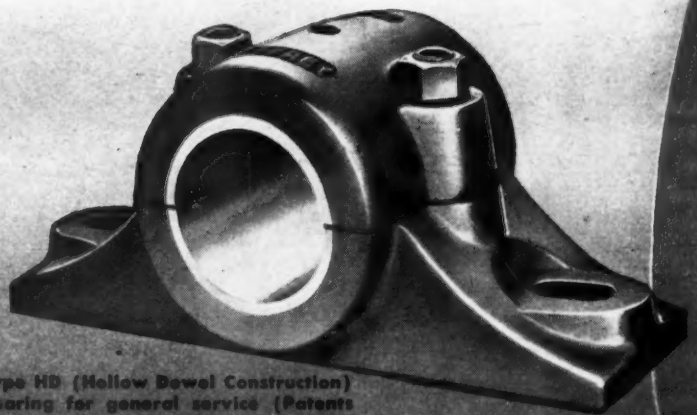


Type J Solid Journal Bearing for small shafts.

Type K Split Journal Bearing for small shafts (Patented).



Type L Angle Bearing for inclined conveyors and elevators.



Type HD (Hollow Dowel Construction) Bearing for general service (Patents Pending). Also Type MG (Machined Gib Construction) Bearing for heavy duty service.

# THE JEFFREY MANUFACTURING COMPANY

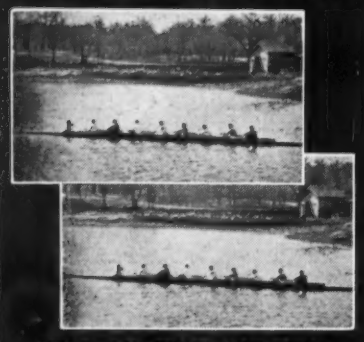
ESTABLISHED 1877

932-99 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

Baltimore 1 · Buffalo 2 · Cleveland 13 · Harlan · Jacksonville · Pittsburgh 22
Birmingham 3 · Chicago 1 · Denver 2 · Houston 5 · Milwaukee · St. Louis 3
Boston 16 · Cincinnati 2 · Detroit 13 · Huntington 19 · New York 7 · Salt Lake City 1
· Philadelphia 3 · Scranton 3

WHAT'S THE DIFFERENCE?



IT'S IN THE WATER

ALL COLLOIDAL K.A.T.* WATER TREATMENT

Water composition is never constant. K.A.T. was developed to meet this condition in your boiler. Since *All-Colloidal* K.A.T. functions by physical action — not chemical reaction — it is effective against all impurities in any water regardless of composition.

Employed as a complete or "finishing" treatment, user records show that K.A.T. improves boiler efficiency. Removes and prevents scale accumulation. Inhibits corrosion. Safeguards steam purity. Lowers fuel, labor maintenance costs. Permits almost continuous boiler operation.

K.A.T.

FIRST STAGE

SECOND STAGE

THIRD STAGE

It will pay you to test K.A.T. in your own plant today.

*Literature on Request*

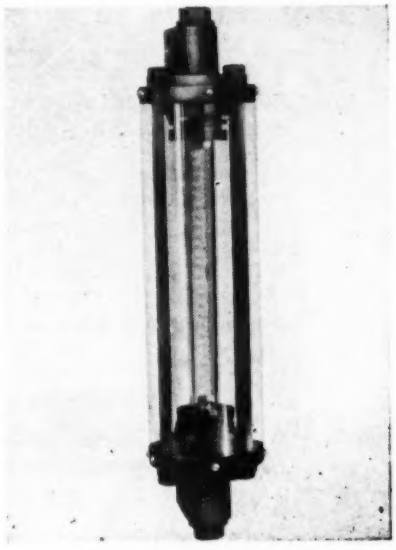
Representatives in principal cities

* T. M. Reg. U. S. Pat. Off.

AMERICAN K.A.T. CORPORATION
331 Madison Ave. New York 17, N. Y.

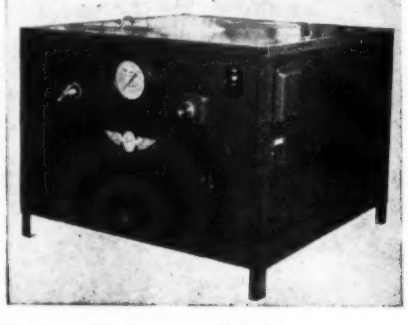
Gentlemen:
Please send me free descriptive literature on K.A.T.
Name.....
Company.....
Address.....
City.....State.....


or buzzer alarm device. Switch functions as soon as temperature in freezer rises to a predetermined danger point. Alarm device begins operating while interior temperature is still relatively low, thus providing a reasonable period of time for emergency repairs before food spoilage. Complete thermostatic element and contact mechanism is self-contained in the device. **Dept P, Cutler-Hammer, Inc, 294 N 12th St, Milwaukee 1, Wis.**



## Vaporproof Rotameter

CLEAR PLASTIC TUBE incloses entire frame and metering tube assembly of new vaporproof rotameter. This over-all covering prevents damage to pyrex tube, or packing glands, and bolts where atmosphere is corrosive in character. Covering also acts as a guard against leakage of fumes where toxic gases are being metered. In latter case, a vent in end fitting may be provided for installation of a small pipe to carry fumes outside the building. In addition, plastic tube protects glass tube against breakage and keeps dust, grease and dirt from external surfaces of tube and packing glands. **Dept P, Schutte & Koerting Co, Philadelphia, Pa.**



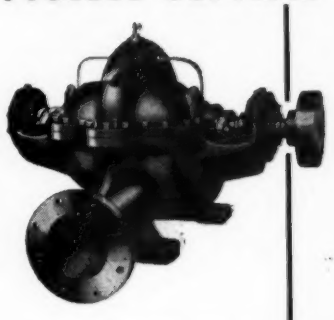
## Hydraulic Power Pack

SELF-CONTAINED HYDRAULIC POWER PACK supplies large volumes of fluid under pressure for operating presses and similar machines using hydraulic fluid for power. A small electric-motor-driven pump stores liquid under pressure in a 10-gal chamber for instant release when called for by the


PEERLESS HORIZONTAL CENTRIFUGAL PUMPS
(Formerly Dayton-Dowd)

PEERLESS PUMPS

TYPE A PUMPS
For General and Process Services



CAPACITIES:
50 to 70,000 g.p.m.

● The Peerless Type A pump is characteristic of the entire line of high quality, heavy duty horizontal centrifugal pumps, manufactured by Peerless to serve the diversified pumping demands of industry, municipalities and water works everywhere.

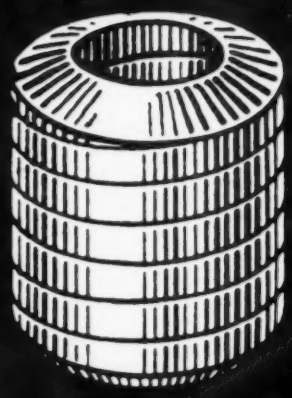
**Peerless Type A Centrifugal Pumps**

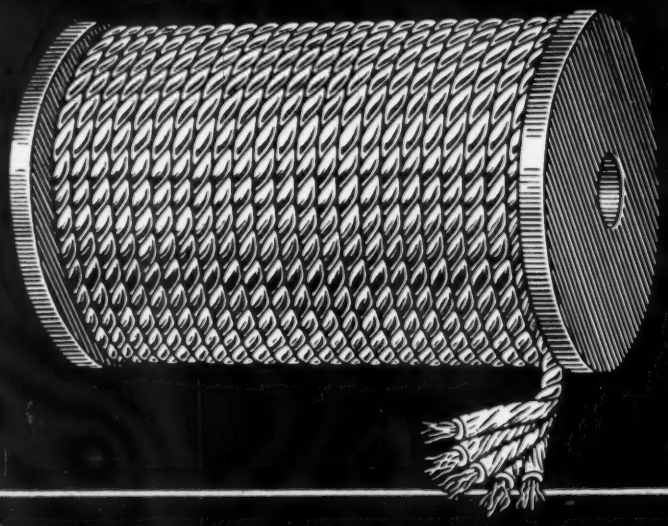
General Specifications: *Capacities*, from 50 to 70,000 g.p.m.; *Heads*, 15 to 300 feet; *Sizes*, 2" to 42" discharge; *Drives*, electric and other types from 1 to 1000 h.p.; *Type*, single stage, double suction, split-case, ball bearing. REQUEST DESCRIPTIVE BULLETIN.

PLAN WITH PEERLESS

For all your pumping requirements, plan with Peerless. Peerless' comprehensive line of pumps includes Underwriters' approved Fire Pumps for plant fire protection, Boiler Feed and Pipe Line pumps and scores of other vertical and horizontal types producing capacities from 10 to 220,000 g.p.m.

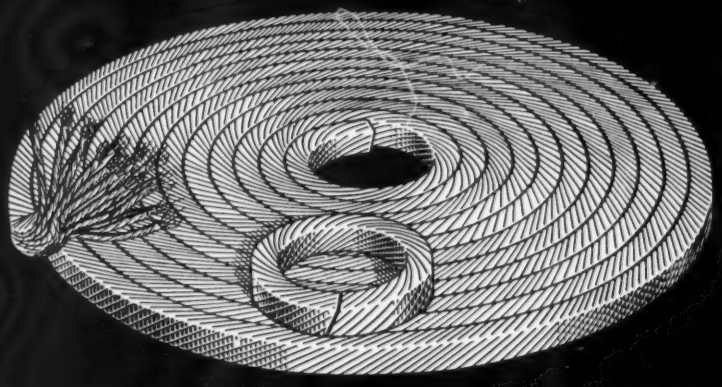
PEERLESS PUMP DIVISION
FOOD MACHINERY CORPORATION
*Factories:*
Canton 6, Ohio • Quincy, Ill. • Los Angeles 31, Calif.
*District Offices:* Canton 2, Ohio; Philadelphia: Suburban Square, Ardmore, Pa; Atlanta: Rutland Bldg., Decatur, Ga.; Dallas 1, Tex.; Los Angeles 31, Calif.





THE ANCHOR PACKING CO. TRADE MARK

# The Unique Construction of Metallic Packings...



## *Produces High Resiliency and Flexibility*

ANCHOR No. 851 is an *improved flexible metallic* Packing fabricated from long asbestos fibre yarn with low-frictional metal and lubricated with a special compound—a unique construction with a number of strands twisted to form a unit having resiliency and flexibility.

**FEATURES OF ANCHOR METALLIC:**

1. Properly applied on rods, shafts or plungers, they are most economical due to their long life.
2. METALLIC is adapted for high speeds of turbines and centrifugal pumps where the least amount of friction will burn packing and score the rod.
3. Is suitable for use on temperatures as high as 500° F. and may be used on high or low pressures in any service where a Babbitt metal is suitable.

***WRITE US FOR COMPLETE DETAILS***

## THE ANCHOR PACKING COMPANY

**GENERAL OFFICES: PHILADELPHIA, PA.**

**FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.**

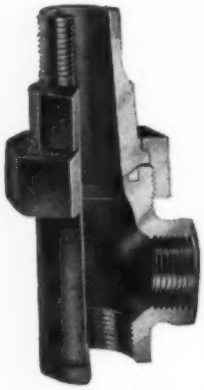
### BRANCH OFFICES

| | |
|---|---|
| Gay and Lombard Streets . . . . . | Baltimore 2, Maryland |
| 150 Causeway Street . . . . . | Boston 14, Massachusetts |
| Andrews Building . . . . . | Buffalo 2, New York |
| Rockefeller Building . . . . . | Cleveland 13, Ohio |
| 230 East Ohio Street . . . . . | Chicago 11, Illinois |
| 4 West 7th Street . . . . . | Cincinnati 2, Ohio |
| 169 West Jefferson Avenue . . . . . | Detroit 26, Michigan |
| 509 Washington Avenue . . . . . | Houston 2, Texas |
| 720 Mateo Street . . . . . | Los Angeles 21, California |
| 5575 Cote St. Paul Road . . . . . | Montreal 20, Canada |
| 418 Common Street . . . . . | New Orleans 4, Louisiana |
| 100 6th Avenue . . . . . | New York 13, New York |
| 401 North Broad Street . . . . | Philadelphia 8, Pennsylvania |
| 405 Penn Avenue . . . . . | Pittsburgh 22, Pennsylvania |
| Terminal Sales Building . . . . . | Portland 1, Oregon |
| 156 South Park . . . . . | San Francisco 7, California |
| 2207 1st Avenue South . . . . . | Seattle 4, Washington |
| 1407 Pine Street . . . . . | St. Louis 3, Missouri |
| 921 South Richmond Street . . . . . | Tulsa, Oklahoma |
| 524 Avalon Boulevard . . . . . | Wilmington, California |

# JEFFERSON

## SPECIALTY UNIONS

**with the RECESSED BRASS SEAT**



Jefferson Union Tee, with Male-Female connections and with Union on the outlet.

## Provide the means for BETTER, TIGHTER piping installations

Leak-proof tightness is obtained in all Jefferson Unions by a patented brass seating feature which provides a true ball joint. Location of this seat is such as to assure free flow through the fitting. Furthermore, any possibility of the screwed end of the pipe coming in contact with the seating ring, regardless of how far the pipe is screwed in, is eliminated. The Specialty Union shown here is one of several in the complete Jefferson line which includes 90° and 45° Elbows as well as Union Tees with union on the run and with union on the outlet.

The completeness of the Jefferson line vastly simplifies piping problems and makes better piping installations possible. Ask your nearest distributor for details or write us direct.

## JEFFERSON UNION CO.

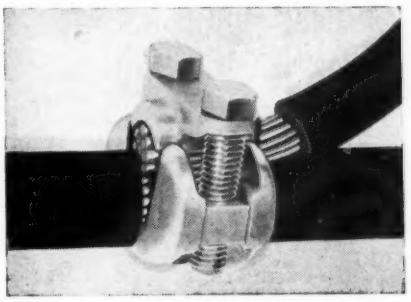
601 West 26th St. New York 1, N. Y.

LEXINGTON 73, MASS. LOCKPORT, N. Y.

Takes a lot of believing to believe that merely adding NCC to a load of fuel oil will eliminate sludge now in a heating system. And forever after prevent the formation of more sludge. But it must be so. Engineers, far and wide, keep buying NCC for plants large and small, with new equipment or old. Tell us what you want to know about NCC—technical bulletins, users' experience or anything else—we'll send the information by return mail.

**NUTMEG CHEMICAL CO.**
**223 State St., New Haven 10, Conn.**


system. Fluid is supplied to the press during the work cycle, after which it returns to the reservoir for the next cycle. Unit is compactly constructed for minimum space and eliminates necessity for large electric motor-driven pumps in intermittent-duty cycles. **Dept P, Greer Hydraulics, Inc, 454-18th St, Brooklyn 15, N. Y.**



### One-Piece Connector

UNIKLIP *KOS*, designed to make compact cap connections, has no separate parts to lose. Recessed bolts are built into rounded streamlined body, thus contributing to its compactness and ease of connecting. Pressure bar is free-swinging. Bolts are accessible from below, thus facilitating installation in close quarters.

*Uniklip* is cast from high conductivity copper alloy and is supplied in five sizes to accommodate all conductors from 4/0 through 100 Mcm. **Dept P, Burndy Engrg Co, 107 Bruckner Blvd, New York 54, N. Y.**

### Stainless-Steel Electrodes

COMPLETE LINE of new stainless-steel electrodes is furnished with a heavy extruded lime coating for dc application. In addition, all but the straight chrome analyses are obtainable with a lime-titania coating for ac or dc. Slag produced by either of these coatings is easily removed.

Electrodes with lime-titania coating are claimed to offer many desirable features not found in lime-coated electrodes. For example, satisfactory usability on ac eliminates arc blow, according to maker, and results in easier manipulation, more uniform arc action, and better appearance of deposit. This class of electrodes can be recommended for all applications on which the lime kind of electrode is used, with possible exception of highly restrained joints on heavy sections or on steels of high hardness. **Dept P, Wilson Welders & Metals Co, 60 E 42nd St, New York 17, N. Y.**

### Aluminum Solder

CORROSION-RESISTANT bonding material *Alsoco* permits soldering alumium to aluminum without flux or flux substitute. Tests revealed material resisted shearing after a 250-hr salt-spray corrosion test states the maker, with three grades showing a 3%, 8.6% and 4.6% loss in strength. Further information resulting from these tests showed (1) an increase in resistance of an aluminum wire soldered to a copper

# *Installed 35 years ago...*

## ..."STILL GOING STRONG"—

LK OF THE TONAWANDAS

### The 'NEWS' of Yesterday

**35 YEARS AGO**

The Buffalo Steam Pump Company has been awarded the contract for the pump that will be installed in the sewage lift station to be constructed on Rumbold avenue.

**Reprinted from Tonawanda, N. Y., Evening News, issue of March 16.**

These Buffalo Sewage Pumps, installed in 1912, are still in daily use in their original location.

Records like the above aren't just accidents. Nor are they the result of ideal pumping conditions —for "Buffalo" Pumps are "going the distance" in some of the toughest pumping jobs in industry today.

The answer lies in the OVERSIZE CONSTRUCTION of every "Buffalo" Pump. Bearings and shafts are oversize. Stuffing boxes are extra deep —to hold extra rings of packing. Pump and motor mountings are solid in every respect.

And you lose nothing in efficiency. "Buffalo" Pumps are precision-fitted for vibrationless performance.

Why not get in touch with your "Buffalo" representative, or write us for the facts? There is a "Buffalo" Pump built to handle your need — at minimum cost—for a long, long time.

## BUFFALO PUMPS, INC.

**488 Broadway** **Buffalo, New York**

**Canada Pumps Ltd., Kitchener, Ont.**

"Buffalo"

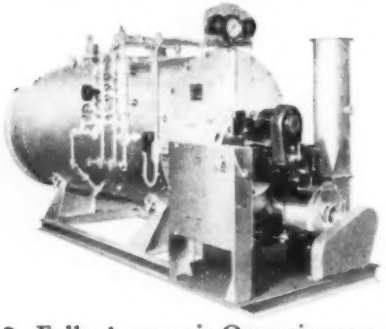
# PUMPS

## FOR LONGER LIFE

We *can* promise you a MORE PROFITABLE job – if you replace your old boiler with a modern Preferred Unit Steam Generator. You'll have a fully-automatic, completely self-contained unit *built* to make your job easier – *planned* to make management's operations more profitable.

**WHY? Because the Preferred is the *only* unit steam generator with *all* these features.**

1. Induced (Pull-through) Draft, a distinctive feature, eliminating the necessity of building costly stacks. Only a simple vent to the outside air required. No escape of products of combustion into the boiler room.



2. Fully Automatic Operation even with Bunker C or No. 6, including the new catalytic residuals.

3. Preferred Oil Burner – built especially for this unit.

4. Four-Pass Gas Travel results in maximum heat absorption.

5. 80% Minimum Thermal Efficiency proved and guaranteed.

6. Low Maintenance–the result of over 27 years of combustion engineering experience.

7. Full range of Sizes from 40 to 500 H.P. and pressures of 15 to 200 lbs. Two-Pass Units in 10-20-30 H.P. and pressures of 15 or 125 lbs.

These features of the Preferred Unit Steam Generator add up to easier operation for you, more economical power plant operation for management and allow you more time around the plant.

Write for booklet "Dividends From Your Power Plant" which is a revelation on Power Plant Operation and New Bulletin #1000 E. P-7-47

**PREFERRED UTILITIES MANUFACTURING CORPORATION**
**1860 Broadway, New York 23, N. Y.**

**PREFERRED UTILITIES**


lug from 20 microhms to 28 microhms after a 250-hr salt spray (2) no failure of the solder itself in vibration tests to failure of a ¼-in. and a ⅜-in. stranded aluminum wire soldered to a copper lug. **Dept P,, Alsoco Corp, 10 E 52nd St, New York, N. Y.**

## Petroleum Solvent

AMBER-COLORED fire-resistant petroleum residue solvent has a viscosity of number 10 oil, flashpoint of 195 F and only slight evaporation up to 175 F. Its manufacturer recommends *Lix-Sol* for cleansing all internal-combustion engine working parts of hardened carbon deposits, sludge, and even lacquer and varnish. Cleaning action involves placing parts in a wire basket, then dipping and agitating the container in a bath of the solution.

Cleaned parts should be doused in water or hosed. This action is reported not to affect a slight rust- and corrosion-protecting film that the solvent is said to leave behind. **Dept P, Coburn Mfg Co, 4716 Troost Ave, Kansas City 4, Mo.**

## Drum Pumps

AIR-OPERATED heavy-duty drum pumps are for factories, contractors and other large-volume users of lubricants. Pumps handle lubricants, sound deadeners, sealing materials, paints and many other compounds directly from 50-gal containers, They operate at high efficiency on a minimum of compressed air. Pumps are available in drum-cover and bung-bushing types in seven pressure ratios of from 40-to-1 to 2-to-1 for any material requirements. **Dept P, Aro Equipment Corp, Bryan, Ohio.**

## Welding Rods

A NEW METALLIC COATING, called *Eutectofilm*, applied to bare low-temperature welding rods, is claimed to give following advantages: (1) Coating improves welding characteristics of rod. (2) It also insures obtaining high physical properties in weld deposit. (3) *Euctectofilm* assists in surface alloying at low base metal heats. (4) It protects filler rod from corrosive attack that would have detrimental effect on weld metal and its flow. *Euctectofilm* is now

## specify heat-beating Deltabeston* wires and cables

In operation, the need for wiring that beats the heat is usually quite apparent but, in the planning stage, it can be easily overlooked. As your plans take shape, make sure that they include Deltabeston wires and cables for every location where heat's a threat. Made specifically to combat the effects of heat, moisture, and corrosive conditions, Deltabeston wires and cables cover a full range of wiring needs. For planning assistance or specifications, write to Section Y77-763, Appliance and Merchandise Department, General Electric Company, Bridgeport 2, Connecticut.

1 ***New Silicone-treated Deltabeston Cables.*** Prepared to withstand temperatures up to 200 C (392 F). Insulation is silicone-treated throughout for toughness and resistance to moisture and heat. Asbestos-insulated and covered with glass braid. For 300- and 600-volt service.

2 ***Deltabeston Power Cables.*** For protection from high heats in locations like power plants and boiler rooms. Use it for general power wiring for temperatures up to 110 C (230 F). For installations in conduit or exposed. Insulation resists heat, flame, moisture, corrosive vapors, and oil.

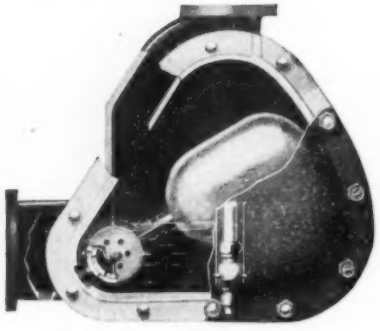
3 ***Deltabeston Switchboard Wire and Bus Cable.*** Essential for wiring switchboards for temperatures up to 90 C (194 F). Insulated with felted asbestos and covered with cotton braid with flameproof finish. Hinge cable available for swinging panel connections and general switchboard work.

4 ***Deltabeston Magnet Wire.*** Class B insulated wire interchangeable with all types of double-cotton insulated wire. Flexible and tough for easy winding and reduced motor maintenance. Made in round, square, and rectangular sections.

*Trade-mark Reg. U. S. Pat. Off.

**GENERAL ELECTRIC**

# ENORMOUS CAPACITY



**Cochrane Multiport Drainers have exceptionally high capacity at low pressure due to the large multiport areas.**

**They are particularly effective in carrying away heavy momentary slugs.**

**They are instantly responsive due to the balanced rotary valve with only one moving element and no stuffing box.**

COCHRANE SINCE 1863

DRAINERS

THEY PROVIDE CONTINUOUS DRAINAGE

THEY ARE COMPACT—OCCUPY VERY LITTLE SPACE

THEY ARE SURPRISINGLY LIGHT IN WEIGHT

*Write for a copy of Publication 2925*

**COCHRANE CORPORATION**
3106 N. 17th St., Phila. 32, Pa.

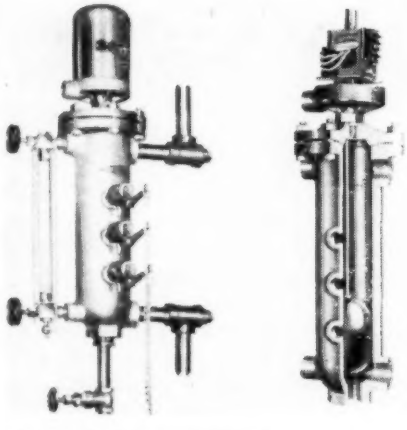
**COCHRANE STEAM SPECIALTIES**


standard on most *EutecRods* (for torch applications).

Company also announces a new welding rod that is said to require less heat and can serve successfully on cast iron, steel, copper, brass, aluminum, zinc die castings and for overlaying. **Dept P, Eutectic Welding Alloys Corp, 40 Worth St, New York 13, N. Y.**

## Powered Roof Ventilator

JECT-O-VALVE uses a propeller fan to exhaust heat, smoke, fumes, etc, through a divided top that opens and closes automatically. This "straight-through" type of powered ventilator is made in five sizes with a wide range of capacities. Ventilator is claimed to be weather-tight at all times. **Dept P, Swartwout Co, Cleveland, Ohio.**



## Water-Level Control

BOILER WATER-LEVEL CONTROL operates through a simple magnetic switching action to provide dependable pump control, low water-fuel cutoff and low water alarm. There is no mechanical or electrical connection between pressure chamber and switching mechanism. *Model* 126 for pressures up to 125 psi and No. 251 for pressures up to 250 psi feature the *Type S Unitary* switching mechanism that is completely self-contained with mercury switch, magnet, lead wires and terminal strips built into a single unit.

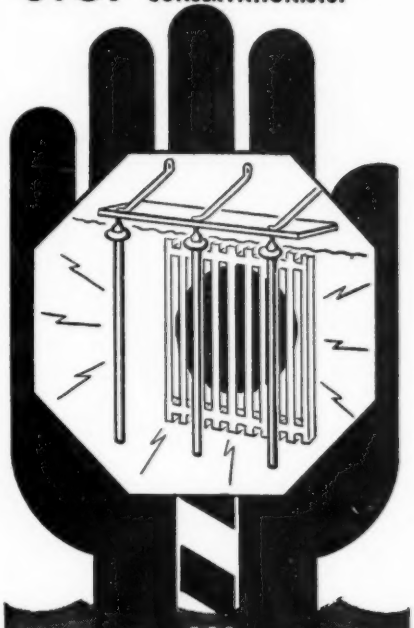
Another new device combines both water column and multistage boiler water-level controller in a single unit. This device,


STOP NEEDLESS DESTRUCTION OF FISH!

STOP HEAD LOSS . . . AT YOUR INTAKES!

STOP SCREEN MAINTENANCE WORRIES!

STOP CRITICISM . . . FROM CONSERVATIONISTS!



AN INVISIBLE BARRIER

YOUR ZONE of PROTECTION

Burkey Electric Fish Screens solve your fish control problems—cheaply, effectively, harmlessly. Electronic impulses keep fish of all sizes *safely* away from intakes or outlets. The electrode systems are custom-built for your particular intake—designed to permit a full head of water. No screen cleaning necessary.

Every Burkey installation is engineered to your problem regardless of size. Burkey Electric Fish Screens are thoroughly proven by years of service in condensing water intakes, hydroelectric plants, water systems and industrial pumping installations. Recommended by State Conservation Officials.

★ SEND FOR LITERATURE AND QUOTATIONS

**ELECTRIC FISH SCREEN CO.**
1130 N. Poinsettia Place • Hollywood 46, Calif

# Only— KD-2 HAS THIS COMBINATION OF PROPERTIES

A.P. Green
KD-2
Registered in U.S. Patent Office
DRY AIR SETTING HIGH TEMPERATURE BONDING MORTAR
KEEP DRY
DIRECTIONS
When using only part of bag, thoroughly mix entire contents of bag before adding water. KD-2 should be mixed in a mortar box, mechanical mixer or other container. For trowelling mix 1 ¼ to 1 ½ gallons of clean water with 100 Lbs. of KD-2. For dipping brick to secure brick to brick joints, mix 3 ¼ to 4 gallons of clean water with 100 Lbs. KD-2.
IMPORTANT - READ BEFORE USING
Do not use KD-2 in enamelware furnaces, bright annealing furnaces, other controlled atmosphere furnaces or furnaces heated by electric elements. Use SAIRSET as a mortar in these furnaces.
A.P. GREEN FIRE BRICK COMPANY
MEXICO, MISSOURI, U.S.A.
100 POUNDS NET

## The *Dry, Air-Setting* High Temperature Bonding Mortar With these *Distinctive* Features

Because of its distinctive binding agent, KD-2 is outstandingly different from other dry, air-setting high temperature bonding mortars generally available to firebrick users today. This new binder aids in the development of the following characteristics, found combined in KD-2:

1. **HIGH BONDING STRENGTH**—The drying and bonding properties of KD-2 are the same as those of other top-quality air-setting mortars intended for use at high temperatures. KD-2, when dried until moisture-free, forms a joint stronger than the average firebrick.

2. **HIGH REFRACTORINESS**—Due to its high refractoriness KD-2 will not soften or run out of the joint at usual temperatures where high heat duty, super duty fire-clay brick or high alumina firebrick may be used.

3. **NO SHRINKAGE**—KD-2 will not crumble away in service because there is no shrinkage in the joints. No joint cracks develop for flame and damaging slags to attack Longer refractory life results.

4. **BETTER WORKABILITY**—The working properties of KD-2 develop without a soaking period. This feature enables the brick mason to use KD-2 as soon as it is mixed. Costly delays are eliminated There is no danger of the mortar stiffening before use.

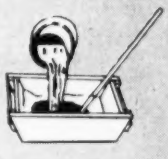
5. **NO DETERIORATION IN STORAGE**—This is an exclusive feature with KD-2. It can be stored indefinitely without deterioration. Partially used bags of material can be returned to storage and used later with no loss in mixing, working or bonding properties.

6. **HIGH WATER RETENTION PERIOD**—The water retention period of KD-2 is greater than 15 minutes. This high water retention period permits the formation of thin joints even with very porous brick and insures its easy-working properties with any type of brick.

KD-2 is not a new product. It has passed exhaustive laboratory tests and has been thoroughly proved in service by refractory users under the name of AIRLOX. It is the identical product under the new name of KD-2 This material is highly recommended for many general refractory mortar applications. Write for folder giving full details.

## KD-2 IS EASY TO USE

Pour KD-2 into mortar box. Dry mix material in mortar box before adding water.



Add water according to printed instructions on the bag.

Mix KD-2 to a smooth consistency and it is ready to use.

A. P. Green REFRACTORY PRODUCTS
SERVE THE WORLD'S INDUSTRIES

# A. P. GREEN FIRE BRICK COMPANY

MEXICO, MISSOURI, U. S. A.

DISTRIBUTORS IN THE PRINCIPAL CITIES OF THE WORLD

# CORROSION-PROTECTED . . . all the WAY!

AT red heat — or sub-zero cold — THUR-MA-LOX-coated steel resists weather and acid-fume attack. Safe at 1600°F., it also stays corrosion-free — before high-heat fusing — for service at any temperature.

THUR-MA-LOX gives this full-range security because it's twice-bonded. A low-temperature vehicle first seals the protecting pigment to the metal. Then, as heat increases, a second vehicle takes over for temperatures that may soar to 1600°F. or drop again to zero or below.

That's one reason why THUR-MA-LOX NUMBER 7 Black is the ideal coating for a steel stack in service under conditions varying all the way from cold standby to red heat. Another is that THUR-MA-LOX takes a real grip and sticks fast, and because it lasts longer, costs less to maintain.

THUR-MA-LOX NUMBER 7 Black is also widely used on breechings, ducts and casings; open hearth and blast furnaces; locomotive front ends; glass furnaces; air preheaters and similar equipment in high-heat service.

In addition to THUR-MA-LOX NUMBER 7, Dampney Coatings include THUR-MA-LOX NUMBER 10 Aluminum, heat resistant to 1200°F., APEXIOR NUMBER 1, for boiler interiors, and APEXIOR NUMBER 3, for cold-water tank interiors.

FOR MORE DATA ON THESE PROTECTIVE SURFACING MATERIALS, WRITE

THE DAMPNEY COMPANY OF AMERICA
HYDE PARK, BOSTON 36, MASSACHUSETTS


which combines all the features of simple magnetic operating principle found in a standard multistage *Magnetrol*, is made in two models: *Model W*-126 for 125 psi and *Model W*-251 for 250 psi. **Dept P, Magnetrol Inc, 2110 South Marshall Blvd, Chicago 23 Ill.**

## Brush Conditioner

FELT-LINED hanger-equipped container holds six paint brushes (maximum size 5 in. across by 11 in. long). Container, known as *Protexem* paintbrush keeper, has a special vaporizing liquid poured into pad. From this storage point, vapor fills container to (1) soften paint in brushes (2) provide a supply of always ready-to-use brushes (3) remove hardened paint without developing loose bristles. **Dept P, Wisconsin Laboratories, Inc, 625 N 23rd St, Milwaukee 3, Wis.**

## Spring Nuts

IN ONE ASSEMBLY OPERATION new spring nut and spring locknut assure a positive locking action on the bolt. One is called the *Diamond G* spring nut and is used the same as the conventional nut. The other is made to supply action similar to a locknut. *Diamond G* spring nut is for hopper feeders and various power wrenches. It has great gripping power on threads of a screw or bolt and, therefore, resists loosening. **Dept. P, George K Garrett Co, 1421 Chestnut St, Philadelphia 2, Pa.**

## Temperature Control

THE NEW INSTRUMENT combines in one unit all the features of Claud S Gordon Co's *Xactline* control unit and Wheelco Instrument Co's electronic principle *Capacitrol.*

Features from the *Xactline* are: an anticipating factor that holds temperature tolerances within 1/5 F plus or minus, power on-off cycle as short as three sec, positive electrical action and simple adjustments for wide range of control requirements. Those from *Capacitrol* are: electronic-control principle, instantaneous control action, direct-reading indicating scale, separately inclosed measuring instrument and interchangeable unit construction. *Xactline Capacitrol* is available in two distinct models for varying requirements. Flush or

# STANDARD ENGINEERS NOTEBOOK

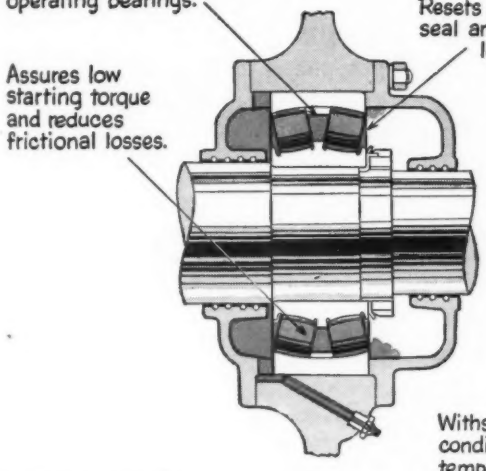
## Anti-friction-bearing grease cuts frictional loss

Ball, and roller bearings in severe conditions of speed and temperature will start easier and operate with minimum running friction if they are lubricated with Calol Grease BRB-340.

This special grease is soft, smooth and has a fibrous texture. At high shear rates, it softens around balls or rollers to give complete coverage of all moving parts. However, because of its peculiar resetting ability, grease swept aside by balls or rollers stays hard enough to form a leak-preventing seal.

Calol Grease BRB-340 contains an unusual amount of high-quality oil stock which provides outstanding lubrication. Bleeding of this high oil content is eliminated by a special milling process.

In a bearing operating 10,000 rpm at 200°F. for 528 hours, Calol Grease BRB-340 showed no separation. The bearing was in good condition at the end of the test.

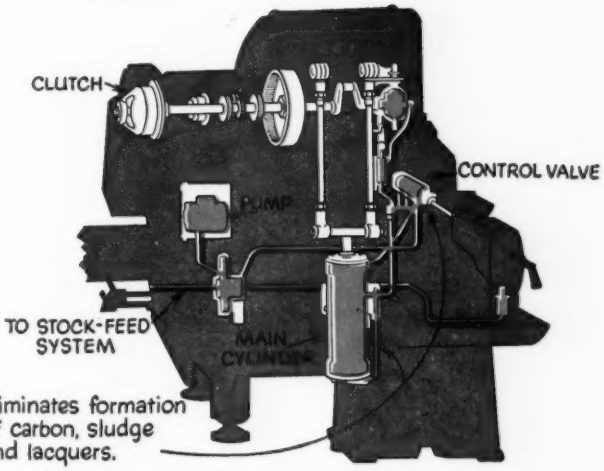

Calol Grease BRB-340 softens to proper consistency in operating bearings.
Resets at edges, forms seal and minimizes leakage.
Assures low starting torque and reduces frictional losses.
Withstands severe conditions of temperature and speed. Non-corrosive to metal.

Roller Bearing for Large Electric Motor.

This drawing prepared with cooperation of SKF Industries, Inc.

Calol O-C Turbine Oil is highly refined — almost water white.

Contains both corrosion and oxidation inhibitors.




Hydraulic Saw-Feed System on Metal-Cutting Saw.

## Inhibited oil stops hydraulic system clogging

The formation of rust, gum and lacquer on cylinders, pistons and valves in hydraulic systems on machine tools may be eliminated by specifying Calol O-C Turbine Oil as the hydraulic medium.

This specially made oil contains both corrosion and oxidation inhibitors. Its resistance to deterioration from oxidation is so great that it is rarely necessary to replace original charges in hydraulic units when contaminants are properly excluded—only oil actually lost need be replaced.

Calol O-C Turbine Oil is also widely used in steam turbines by operators who require the finest turbine oil available. It assures protection against rust in initial operation as well as throughout the life of the oil-charge.

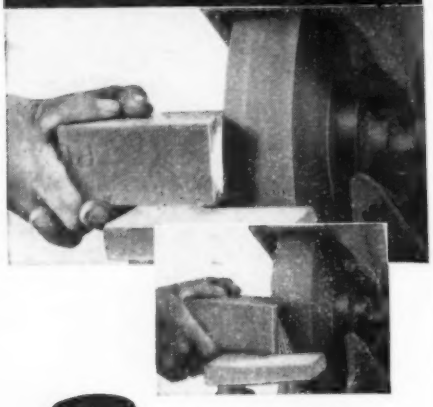
Calol O-C Turbine Oil will withstand high operating temperatures and pressures, and is highly moisture-resistant. Comes in four viscosity grades: 9, 11, 15 and 19.

Trademarks, "Calol," "RPM," Reg. U. S. Pat. Off.

For additional information and the name of your nearest Distributor, write Standard of California, 225 Bush Street, San Francisco 20, Calif.; The California Oil Company, 30 Rockefeller Plaza, New York 20, N. Y.; The California Company, 17th and Stout Streets, Denver 1, Colo.; Standard Oil Company of Texas, El Paso, Texas.

**FOR EVERY NEED A STANDARD OF CALIFORNIA JOB-PROVED PRODUCT**

# BRICKSEAL
## REFRACTORY COATING



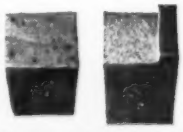
*Resists*

## ABRASION

PROTECTION against abrasion is an outstanding advantage of Brickseal. Here are two refractory bricks, one coated with Brickseal, the other uncoated. They were heated to more than 2000°, taken directly from the furnace, cooled and shoved against an emery wheel. Hot and cold, the Brickseal-treated brick resisted the abrasion – see below.

Brickseal consists of high fusion clays and metal oxides combined in oil. Furnace heat burns away the oils and vitrifies the clays and metals which penetrate deeply into the pores, cracks and joints. Brickseal prevents cracking, spalling and slagging regardless of sudden temperature changes. Brickseal is also a mortar for laying up refractory walls.

*Compare the Brickseal-treated brick at the left to the untreated at the right.*



## TRY IT YOURSELF

*Two bricks bonded together and partially coated with Brickseal will be mailed to you on request.*

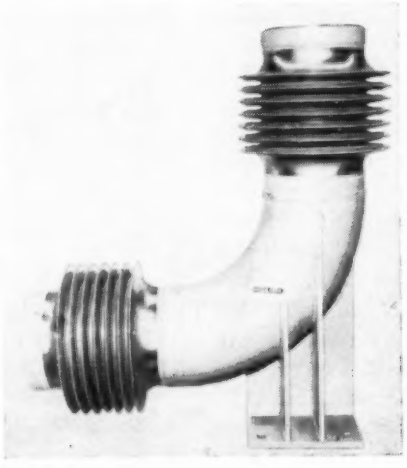
**BRICKSEAL**
**REFRACTORY COATING**
5800 So. Hoover St., Los Angeles, Calif.
1029 Clinton St., Hoboken, New Jersey


surface mounting case, plus simple design and compactness, make installation simple. **Dept P, Claud S. Gordon Co, 3000 S Wallace St, Chicago 16, Ill.**

### Spray Welder

NEW SPRAY WELDER combines both welding and metalizing procedures. The apparatus operates in first step as a powder metalizing unit to apply a uniform overlay of hard-facing alloy. It is then used as a conventional welding torch to fuse this sprayed overlay to base metal.

Unit consists of the gun and all necessary hose. A hopper, for the powdered metal, and carburetor are combined. **Dept. P, Wall Colmonoy Corp, 19345 John R, Detroit 3, Mich.**



### Elbow Expansion Joint

PACKLESS ANCHOR-BASE elbow-expansion joint can be supplied in all standard pipe sizes and in a choice of materials to meet special corrosive, temperature and pressure conditions. Photo shows a 10-in. pipe size unit about 4 ft high that accommodates 40-psi steam pressure. Each bellows allows 1½-in. total movement with 30-in. over-all free length. Bellows of this unit is fabricated from stainless steel and the *L* used is standard-weight 10-in. carbon-steel pipe. Joint shown was designed for operation at temperatures up to 360 F. **Dept P, MagniLastic div, Cook Electric Co, Chicago 14, Ill.**

### Belt Conveyor

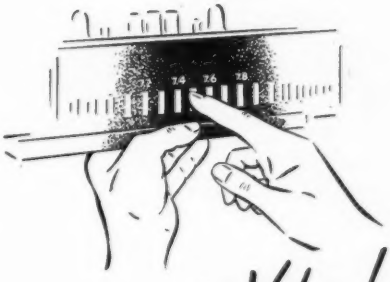
PREFABRICATED BELT CONVEYOR, called *Mercury*, has all parts including the belt made of heat-treated aluminum alloy to provide ample strength, lightness and easy handling. It is rust-proof and corrosion-proof and resistant to most acids, chemicals and fumes. Suited to food industries, and to production, assembly, shipping and warehousing, conveyor is available in 6- to 60-in. widths and from 15-in. high up. Standard height is 36 in.

Prefabricated in 5-ft sections for assembly in continuous units up to 150 ft, belt conveyor operates at speeds up to 100 ft per min, load capacity 250 lb per sq ft, pulling load 6100 lb. Belt fastened to chain on both sides for its full length provides


## Taylor Comparators

# Simplify

## BOILER WATER TESTING!



*There's the Value!*

***You** get Speed* . . . with a simple, three-step operation!

***You** get Simplicity* . . . no handling of fragile Nessler tubes!

***You** get Accuracy* . . . liquid color standards carry an UNLIMITED guarantee against fading!

***You** get Economy* . . . standard slides for silica, nitrate, pH, phosphates, etc., may all be used on one single base!

***You** get Durability* . . . sets are made of plastic, light in weight, extremely portable!

***You** get Convenience* . . . no single standards to handle. Complete sets of color standards enclosed permanently in slides.

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Ask for free copy of "Modern pH & Chlorine Control" . . . 88 pages give detailed information on Taylor methods and equipment . . . theory and application in 34 basic industries.

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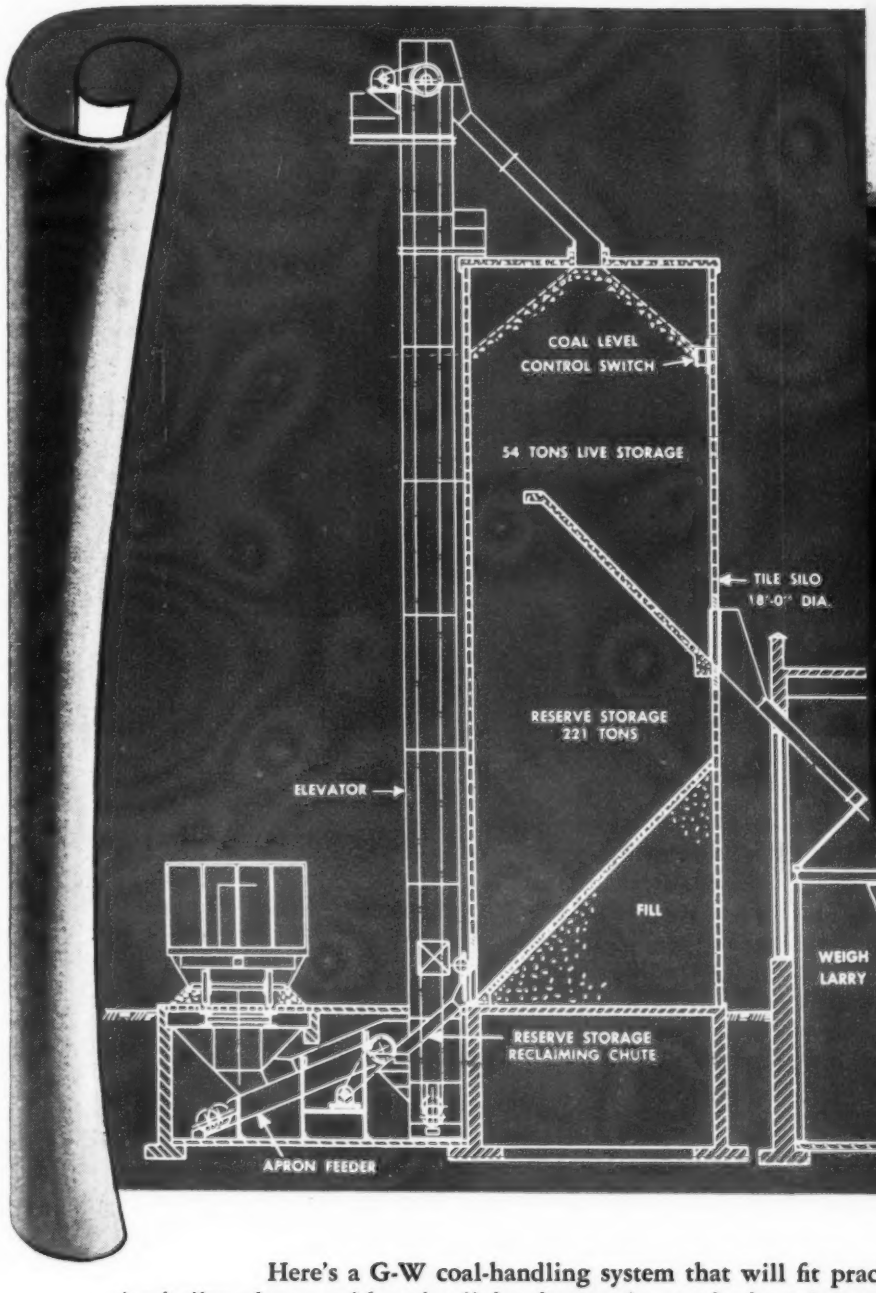
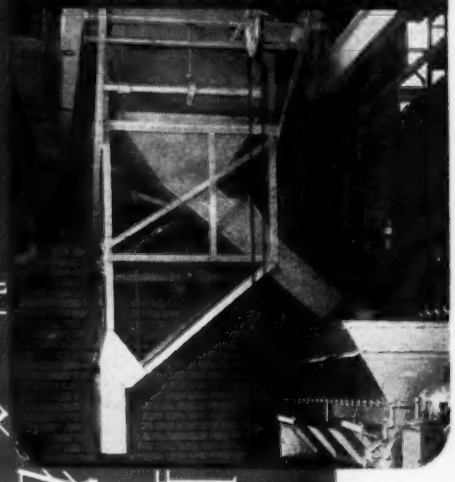
# BIG or small... ANY PLANT Can use this system



G-W Bucket Elevator and Vitrified Tile Silo; Veterans' Administration, Ft. Custer, Mich.

•

G-W Weigh Larry distributes coal to stoker.



Here's a G-W coal-handling system that will fit practically any condition in any size boiler plant – with only slight changes in standard equipment. Storage silo may be vitrified tile or concrete; coal transported from track hopper by apron, drag or reciprocating feeder; discharged from silo to stoker by spouts, screw conveyor or traveling larry.

Let G-W design your complete system, furnish and install all equipment – assume sole responsibility from start to finish. Ask a G-W engineer to study your plant conditions and make recommendations.

•

**GIFFORD-WOOD CO.**
420 Lexington Ave. New York 17
565 W. Washington St. Chicago 6
*Factory:* Hudson, N. Y.

**G-W HANDLES IT...**
**faster • easier • cheaper**

**GIFFORD-WOOD**
**SINCE 1814**

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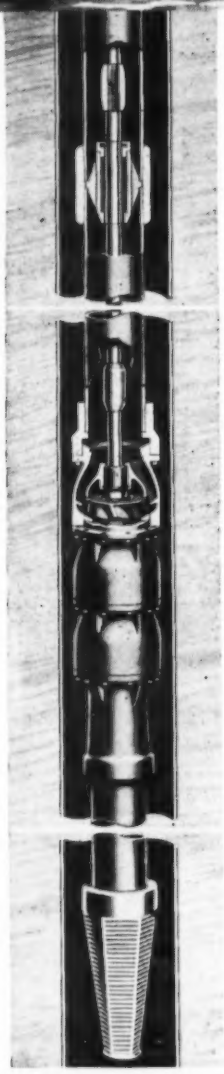


## *Install a Deming*
## TURBINE PUMP

*What is WATER costing your company?* It's a question many companies are asking themselves in these days of mounting costs of doing business. Their search for ways and means of *reducing* costs wherever possible automatically leads to such items that CAN be controlled by proper action. The cost of WATER is one of those items.

Conclusive evidence that many companies, where Deming Deep Well Turbine Pumps are installed, are saving thousands of dollars annually is available to you upon request. In several cases, the complete cost of drilling a deep well, installing the Deming Turbine Pump, and all related costs of operation, maintenance, depreciation on the investment, etc., have been paid for by SAVINGS during the first year.

Deming Deep Well Turbine Pumps are built for wells 4" to 16" or larger. Capacities range from 15 to 3,000 gallons per minute. Features of construction are described in a 20-page, 8½" x 11" bulletin. Copy on request.

*Write for illustrated* BULLETIN 4700-B

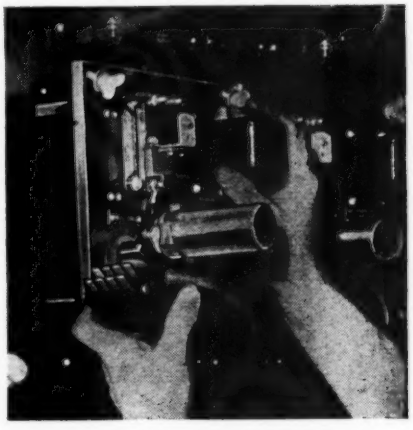
THE DEMING CO.
204 BROADWAY
SALEM, OHIO, U.S.A.

DEMING
INDUSTRIAL PUMPS


smooth positive drive. Maximum temperature limit is 500 F. It is completely inclosed for safe operation. **Dept 106, Patron Transmission Co, 129 Grand St, New York 13, N. Y.**

### Rotary Gates

CONSTRUCTED OF ALUMINNUM ALLOY and used for handling bulk material, rotary gates supplement those made of cast iron and stainless steel. Designed for use with fine materials, such as soot, flyash, cement, fluor spar, pulverized limestone, etc, gates are quick-acting, totally inclosed and dust-tight. Rotor's pipe-size opening does not restrict material flow. Material does not have to be displaced to close gate even when plugged full, because material revolves with gate. Gates can serve at any angle and rotor be removed without disturbing body connections to chute, hopper or bunker. **Dept P, Beaumont Birch Co, Philadelphia, Pa.**



### Quick-Change Control Unit

DESIGNED FOR RAPID and easy servicing, the quick-change electronic control unit panel is especially adaptable to steel mill, rubber mill, printing plant and similar applications. A captive wing-nut mounting and multiple contact plug arrangement permits instant substitution of a spare panel at any time with virtually uninterrupted machine operation. Units are exchanged whenever emergencies arise that require removal of electronic unit for testing or servicing; thus no costly shutdown of production machines results during maintenance operation. **Dept P, Cutler-Hammer, Inc, 294 N 12th St. Milwaukee 1, Wis.**

### Arc-Welding Electrode

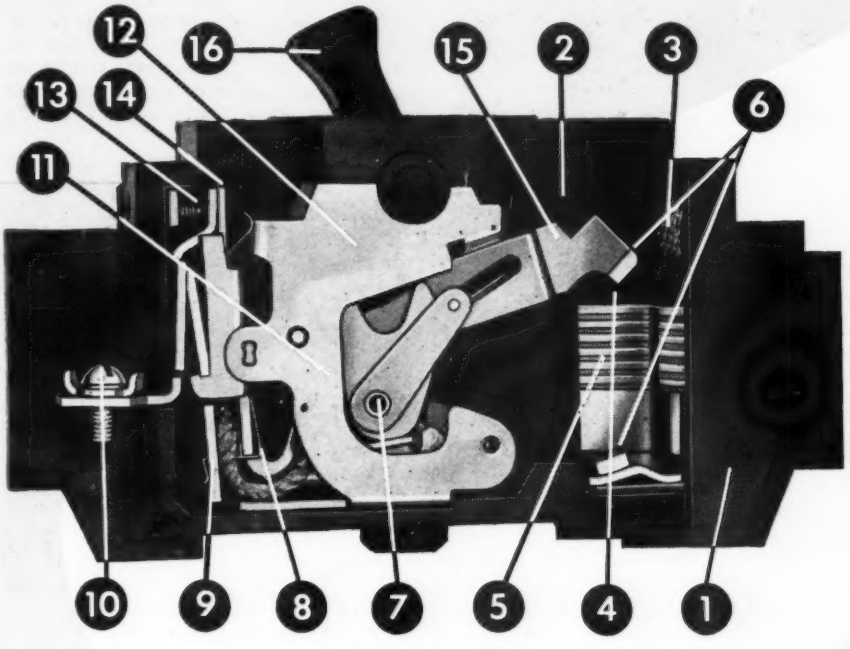
FOR WELDING LOW-ALLOY CAST STEEL or low-alloy high tensile strength rolled steel in all positions, with ac or dc reverse polarity, the new *ACP-MO* electrode is available in four diameters from 3/32 to 3/16 in.

Although designed primarily for ac, this electrode is exceptionally good with dc, reverse polarity. *ACP-MO* is for vertical or overhead welding, although it produces equally satisfactory results in making horizontal fillet and flat-position welds. Welds made with this electrode meet requirements of *AWS-ASTM* tentative

NEW NEW NEW NEW NEW NEW NEW NEW NEW

# QUICK / TRIP MAKE BREAK THERMAL-*Coilless* MAGNETIC CIRCUIT BREAKER

**Type ML A.C./D.C. 1, 2, or 3 Pole, 15 to 50 Amperes for Direct or Alternating Current Systems**




1. Mechanism is completely enclosed in a sealed, compact, molded bakelite case to prevent tampering
2. Narrow slot for edgewise contact arm isolates arc chamber
3. Arc chamber vent screen
4. Arc suppressor chamber
5. Arc suppressor stack especially designed to instantly rupture both direct and alternating currents
6. Silver tungsten contacts brazed to contact arms and plates
7. Bearing surfaces are hardened to reduce wear
8. Stainless steel sensitive latch
9. *Coilless* magnetic trip element
10. Terminal screw for lower ampere ratings
11. Main spring (concealed) provides positive contact pressure and strong mechanism action
12. All-steel parts are rust-proofed to prevent corrosion
13. Sealed bimetal adjustment screw
14. Bimetal for delayed trip
15. Solid, high strength, high conductivity cadmium copper edgewise contact bar
16. Strong cross section molded bakelite handle

This new and vastly superior Square D thermal-magnetic breaker has a unique *coilless* magnetic tripping mechanism which causes it to open instantly on moderate as well as heavy short circuits. A quick-make and quick-break mechanism of simple and rugged construction is incorporated in this breaker to assure long life and trouble-free service.

New lines of lighting panelboards, also general purpose industrial service equipment enclosures, using these new breakers, are now available for delivery.

The ML A.C./D.C. breakers are designed for use on either direct or alternating current systems where 1, 2, or 3 pole circuits are required. They are ideal for motor or branch circuit wiring.

*Write* for Information on ML A.C./D.C. Breakers.
Square D Company, 6060 Rivard St., Detroit 11, Michigan.

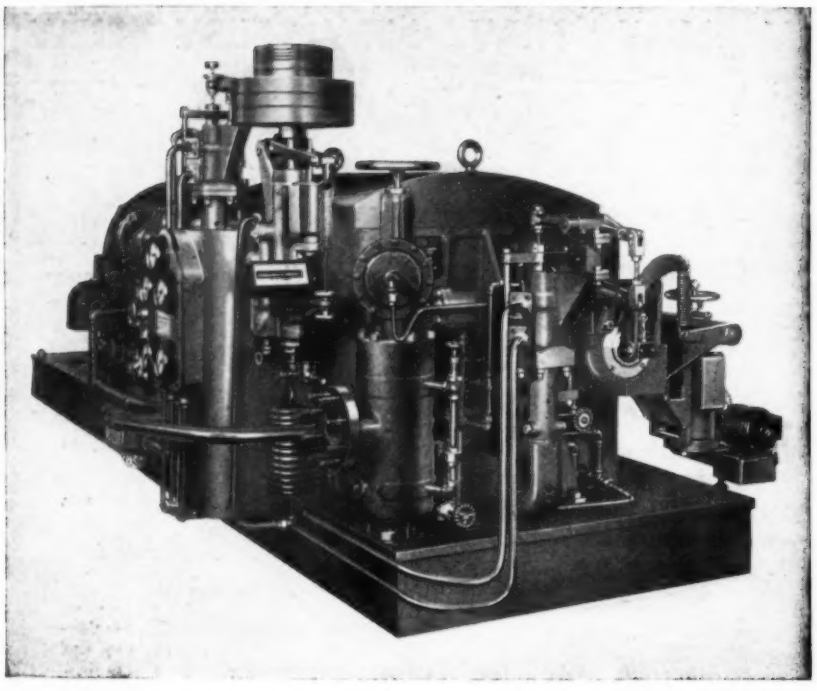
## *Features*

- HOLDS MOMENTARY OVERLOADS (thermal trip)
- TRIPS FAST ON SHORT CIRCUITS (*coilless* magnetic trip)
- QUICK-MAKE, QUICK-BREAK (manual operation)
- QUICK-BREAK (automatic operation)
- MEETS FEDERAL SPECIFICATION WP131A FOR CLASS 1 BREAKERS

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

*In Canada:* SQUARE D CANADA, LTD., TORONTO, ONT. • *In Mexico:* SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.



# LARGE TURBINE PERFORMANCE FOR THE SMALL PLANT

An outstanding advantage of Murray Turbines is that they give the small plant many of the desirable operating economies enjoyed by larger plants.

The illustration above shows a typical job of this kind — a 175 KW Murray Extraction Turbine installed in a midwestern packing plant.

This modern unit operates with steam at 235 lb. pressure — 500 deg. F. total temperature, and exhausts at 27 in. vacuum. Steam is extracted automatically at 60 lb. pressure.

*Let our engineers cooperate in smoothing out your power problems.*

**MURRAY IRON WORKS COMPANY**

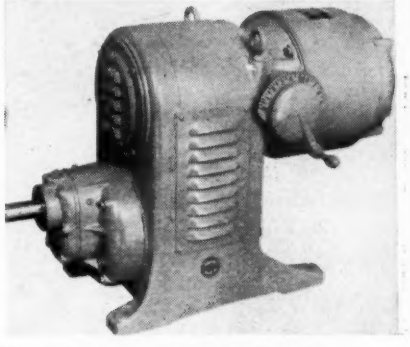
**BURLINGTON, IOWA**

*Builders of Steam Power Equipment for Three Quarters of a Century*

specifications for iron and steel arc-welding electrodes classification *E*-7011. **Dept P, Westinghouse Electric Corp, P O Box 368, Pittsburgh 30, Pa.**

## Cast-Iron Solder Rod

ALL-STATE No. 7 CAST-IRON ROD repairs cracks on cast iron. Rod serves with All-State No. 7 flux, except for brazing dissimilar metals to aluminum, where No. 53 flux is used. This rod produces corrosion-resistant welds and is excellent for repairing cracks in cast iron that must be water-tight and pressure-tight against pressures up to 1000 psi. It is also used for sealing and filling cracks and blowholes, and for building up where strength is not required. It melts at 600 F and is said to tin easily and rapidly. **Dept P, All-State Welding Alloys Co, 96 West Post Rd, White Plains, N. Y.**



## Variable-Speed Motor Drive

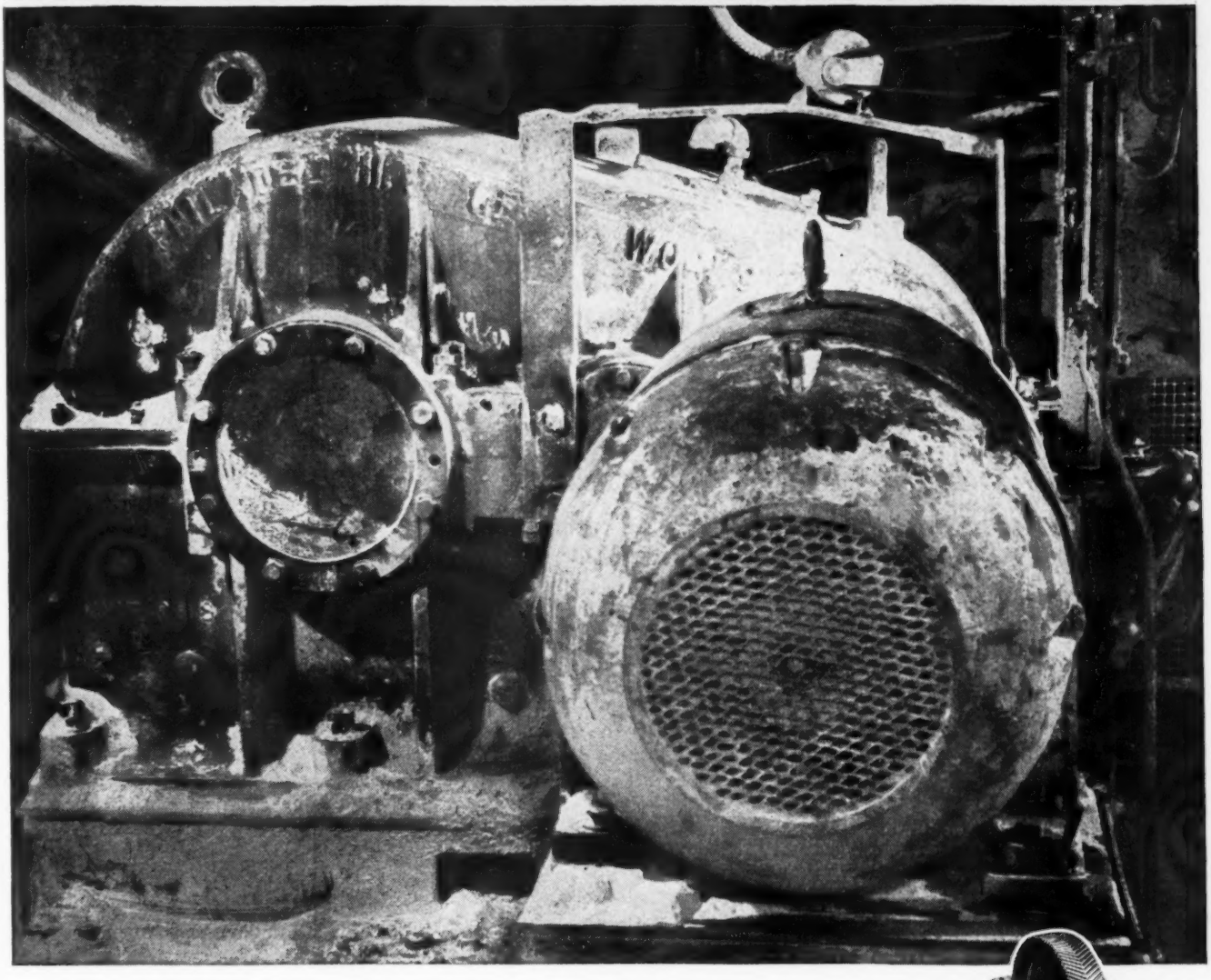
VARIDRIVE MOTOR, designed as Size 23, is first of a new series of variable-speed drives. Outstanding features of this unit are (1) small size for a given hp (2) long belt life (3) convenient location of speed adjustment handwheel (4) provision for easy change of *Varibelts*. Available in a wide variety of assemblies, this unit fits almost any application, such as horizontal frame with shaft left or right, upright frame with shaft high or low, and built-in speed reducers of single or double reduction. Speed variations from 2:1 to 7:1 are obtainable up to 5-hp output. **Dept P, U.S. Electrical Motors, Inc, Milford, Conn.**

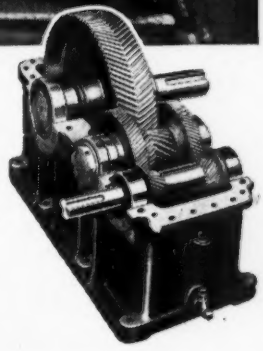
## Safety Switch

BULLETIN 1300 WEATHERPROOF SAFETY SWITCHES are for outdoor application and other locations where adverse atmospheric conditions prevail. These *Type A* switches are exceptionally compact and of rain-tight and dust-tight construction. Inclosures are heavy-gage steel, aluminum finish, and have slanted roofs with drip-trough over front door. A heavy sponge-rubber gasket makes a tight seal between door and box.

Switch mechanism is fully interlocked to prevent opening door with switch in "on" position. Single door construction is standard for most sizes, with double door optional. **Dept P, Electric Controller & Mfg Co, Cleveland 4, Ohio.**

# THIS PHILADELPHIA HERRINGBONE REDUCER *really takes a "TERRIFIC BEATING"...*



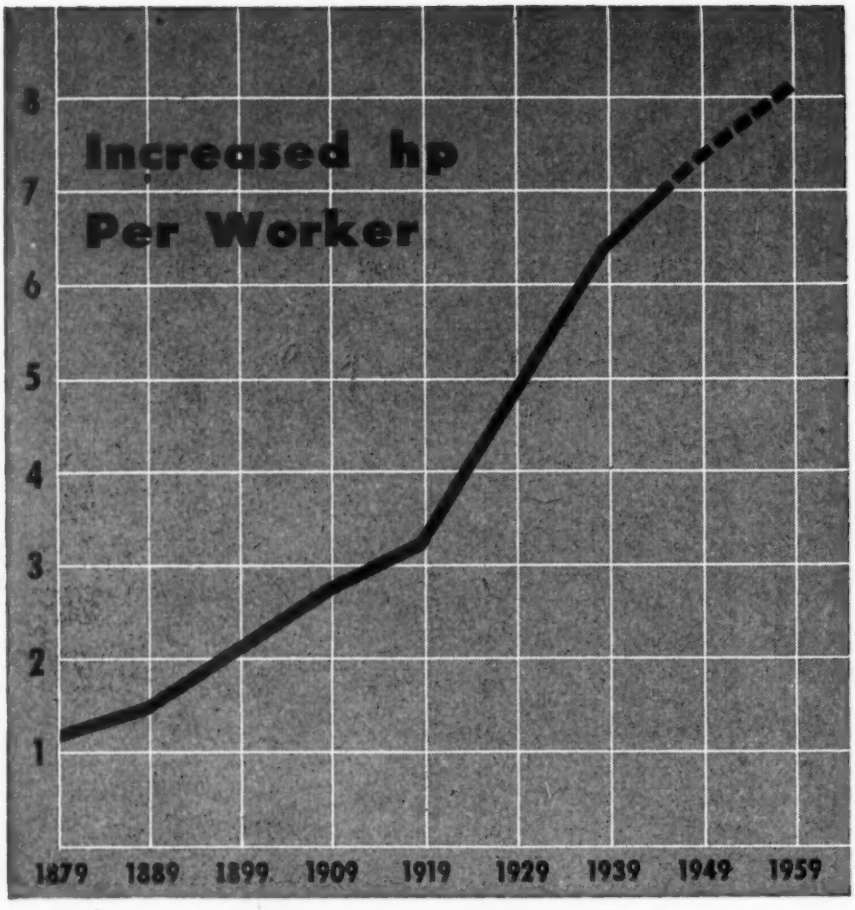


The unit shown above is a Philadelphia Double Reduction Herringbone Speed Reducer, driving a 36" drag conveyor on a lime kiln discharge . . . reduction ratio 53 to 1. It operates almost continuously under severe conditions of heavy loads, dust, abrasion and dirt, . . . yet is always on the job, and has been for many years.

Philadelphia Herringbone Units are used by thousands, and are available in Single, Double and Triple types. Send for Catalog #H-39, and please use your Business Letterhead when requesting same.

**Philadelphia**
**GEAR WORKS INCORPORATED**
**ERIE AVE. AND G ST., PHILADELPHIA 34, PA.**
NEW YORK • PITTSBURGH • CHICAGO . . . IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

***Industrial Gears and Speed Reducers***
***LimiTorque Valve Controls***




# More Power...

## LESS COST!

During a period of many years, American Industry has progressively used more horsepower per worker. This additional energy, driving improved machinery in larger quantity, has raised our standard of living by steadily increasing production despite great reduction in working hours.

Surveys indicate that half of all industrial equipment is now over twenty years old. The difference between physical deterioration of old facilities and continuous improvement in new equipment allows a tremendous margin for savings. To take advantage of these savings, increased power and power facilities may be necessary.

Kuljian Engineers have specialized for years in power plant design, construction and operation. It will pay you to call on us for assistance in modernizing your power facilities. Your inquiry is invited, without obligation.

THE KULJIAN CORPORATION

*Engineers • Constructors*

1518 Walnut Street • Philadelphia 2, Pa.

New York 6 Washington 5

## Power News

(*Continued from page* 192)

factors affecting output and quality of diesel oils, stressing the fact that, because of the economics, the best source of low-cost fuel is domestic and industrial fuel-oil production, which is on a large scale. With engines able to operate satisfactorily on these fuels, the diesel industry will benefit from further application of catalytic cracking, which tends to produce fuels superior to those from thermal cracking. The authors also called attention to possible problem arising out of need to use more crudes high in sulphur content.

The entire problem of bearings for diesel engines—their engineering design, materials of their construction and their lubrication and operation—was covered in a series of four papers by E Crankshaw and G W LaPier, Cleveland Graphite Bronze Co; W E Thill, Federal-Mogul Corp; B J Esarey, National Bearing Div, American Brake Shoe Co; and D B Wood, Aluminum Co of America. A comprehensive abstract of these papers will appear in an early issue of POWER.

The papers presented at the Conference, together with the discussion, will be issued in the form of *Proceedings*, to be available within a few months. Engineers interested in obtaining copies should address *American Society of Mechanical Engineers, 29 W 39th St, New York 18, N. Y.*

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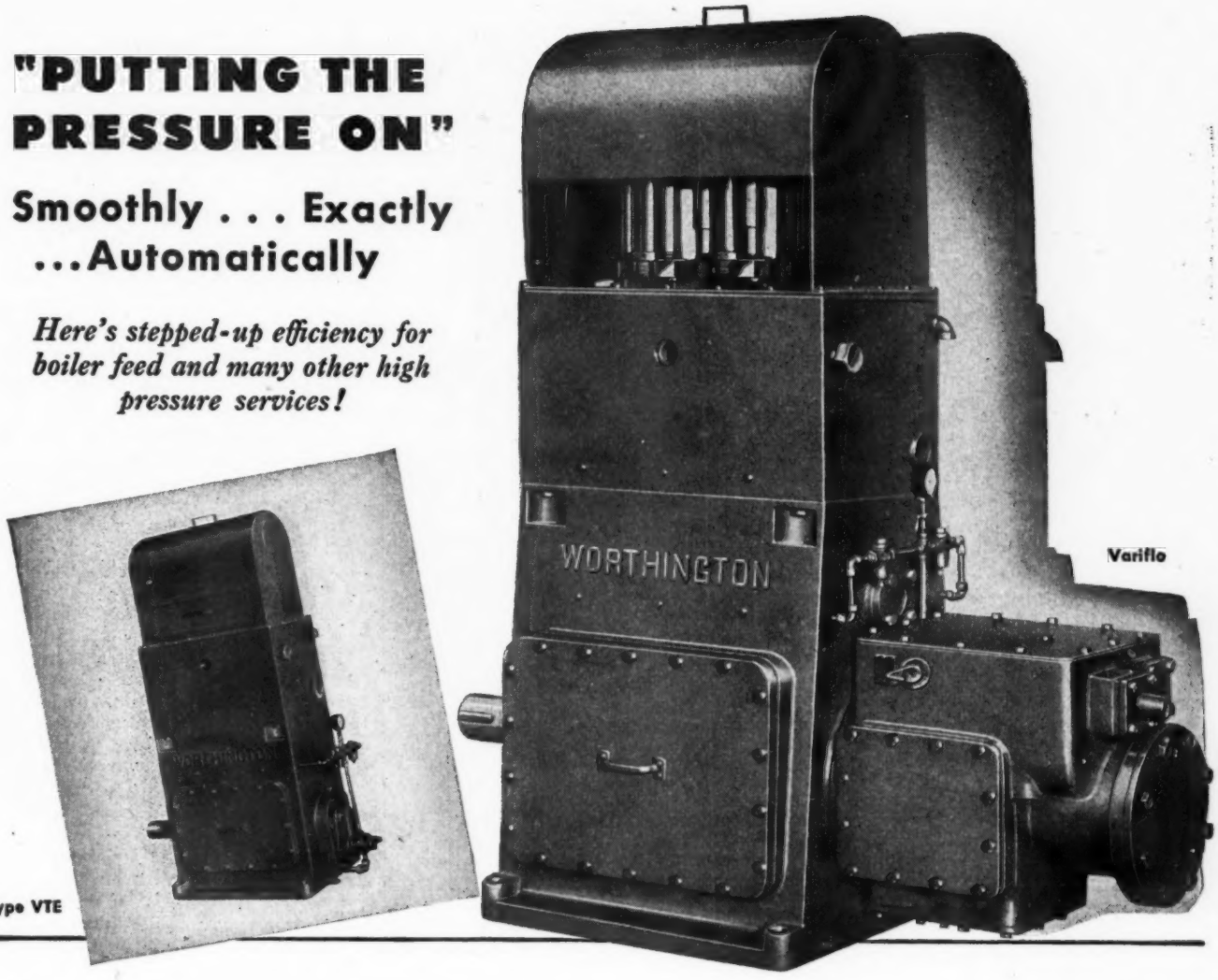
**Technical Societies Council of New York** received its certificate of incorporation, dated Apr 7, 1947, under laws of State of New York. The council, organized on July 16, 1946, is composed of engineering and technical societies in greater New York and has as its main objectives the advancement of engineering, scientific or technical knowledge and practice of high professional standards.

The following 14 societies are charter members of the Council and it is expected that other engineering, scientific and technical societies, whose qualifications conform with requirements of the Council's constitution, will become members: American Institute of Chemical Engineers, American Institute of Electrical Engineers, American Institute of Mining & Metallurgical Engineers, American Society of Heating & Ventilating Engineers, American Society of Mechanical Engineers, American Society for Metals, American Society of Safety Engineers, American Society for Testing Materials, American Society of Tool Engineers, American Chemical Society, American Welding Society, Illuminating Engineering Society, Institute of Radio Engineers, Society of Motion Picture Engineers.

# "PUTTING THE PRESSURE ON"

## Smoothly . . . Exactly ...Automatically

***Here's stepped-up efficiency for boiler feed and many other high pressure services!***




**Positive, Accurate Capacity-Control**

Operating at constant speed, Worthington Variflo Triplex Pumps regulate capacity by a simple, rugged eccentric which adjusts the plunger stroke to any degree from zero to 100%. Variation is completely *stepless and automatic*, with smooth, positive action that saves power over the entire capacity range.

**Type VTE**

Except for the crankshaft elements, the simple, compact, accessible design of Worthington Type VTE Triplex Pumps is identical with the Variflo's. Where variable capacity is not required, they perform with the same high dependability that proves *there's more worth in Worthington.*

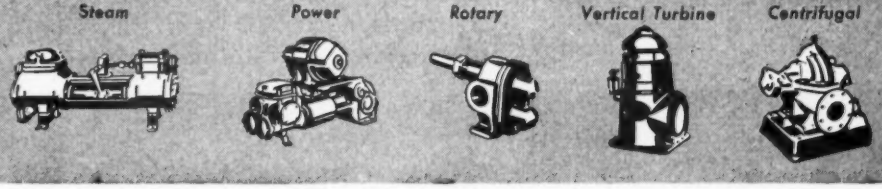
**Constant Speed — Constant Savings**

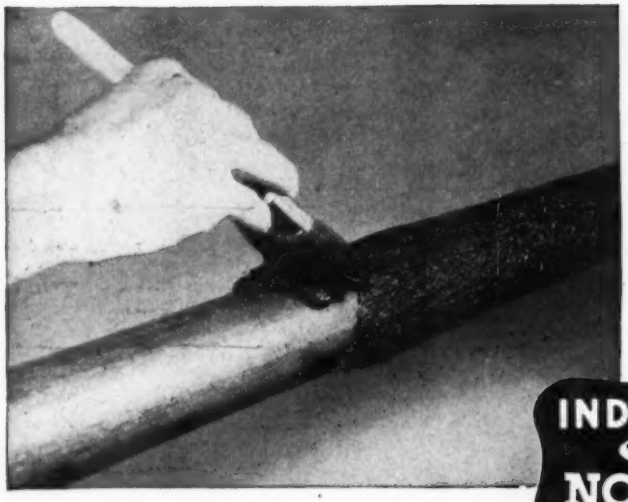
In Worthington Variflo and VTE Pumps the mechanical superiority and money-saving advantages of constant speed design have been developed to their fullest. Available in a complete range of sizes up to 165 gpm, in single units. Write for bulletins to *Worthington Pump and Machinery Corporation, Reciprocating Pump Division, Harrison, N. J.*

# WORTHINGTON

THE WORLD'S LARGEST MANUFACTURER OF PUMPS

P7-1





COVER PIPES, TANKS, WALLS, with

INDUSTRIAL NoDrip

Anyone can brush, trowel or spray NoDrip on any clean, dry surface. Goes on like plaster, forms a seamless, protective coating which effectively ***stops condensation drip.***

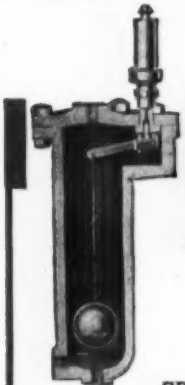
NoDrip keeps equipment and floors safe and dry; prevents corrosion of metal and prolongs its life. Acid, alkali and brine resistant. Comes in 1, 5 and 55 gallon drums, ready for use.

***TRY NoDrip***

Apply NoDrip to a small area, compare the results with uncovered portions.

***Send for Free NoDrip Handbook***

**J. W. MORTELL CO.** **549 Burch St., Kankakee, Ill.**

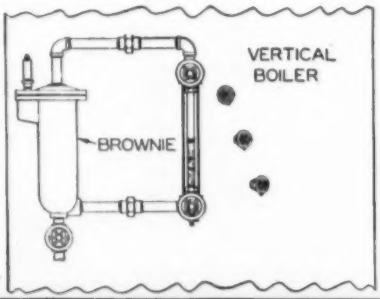


"BROWNIE" LOW WATER SIGNAL

***Protects Small Boilers***

**SPECIFICATIONS**

| | |
|---|---|
| Weight | 17 lbs. |
| Pipe connection | 1/2" |
| Bottom to top of cover | 12" |
| Bottom to top of Whistle | 18" |
| Steam Pressure | 5 to 150 psi. |




**Simple to install and effective in operation, a "Brownie" is also inexpensive protection against the danger of low water level remaining unnoticed.**

**Note in the diagram how easily it is connected to the water gauge fittings. Note also that the "Brownie," because of its lightness, needs no bracket to support it.**

**Order from your supply house or send for Bulletin 570-B.**

**Distributors and Agents in all Principal Centers.**

SERVING INDUSTRY FOR MORE THAN 50 YEARS

WRIGHT AUSTIN

WRIGHT-AUSTIN CO.
316 W. Woodbridge St.
Detroit 26, Michigan


## Bureau of Mines Opens Colorado Oil-Shale Plant

Offering promise of a vast new industry for America, oil from an untouched reserve flowed from the $2,000,000 oil-shale demonstration plant of Bureau of Mines in western Colorado when this first major unit, completed under the synthetic liquid fuels program, was dedicated on May 17.

On the U. S. naval oil-shale reserves, 7½ miles west of the town of Rifle, the new plant is the first of two demonstration units planned under a 5-year $30,000,000 program of synthetic liquid fuels research and development. This is one of the few Interior Dept programs that was not drastically curtailed by the House appropriation bill. More than half of the nation's entire shale-oil reserve is in this section of western Colorado, where beds 500 ft thick, and more, contain an average of 15 gal of oil to the ton of shale, or 300,000,000 barrels to the sq mi. Recoverable shale oil in the U. S. is estimated at 92 billion barrels, equivalent to four times the known natural petroleum reserves.

Processing and cost problems to be solved at the new plant are threefold, including mining the shale, extracting the oil and refining it into products acceptable for commercial use. To do the job assigned by Congress, Bureau of Mines engineers within a little more than two years have selected a site after extensive surveys, supervised construction of an access road system, 7½ miles long over rugged terrain, opened two shale mines, laid out and erected a housing development of 50 units, designed and directed installation of a complex shale-treating plant, installed power, water and sewage systems, and built numerous auxiliary structures.

### RICHEST BED MINED FIRST

The mines were opened in vertical cliff faces where the oil-shale beds outcrop 3000 ft above the Colorado River, one to supply the demonstration plant with selectively mined shale of any richness needed from 10 to 60 gal of oil to the ton, and the other to determine large-scale mining costs. Workings in the selective mine include 1736 ft of passageways. Wide entries have been driven and rooms are being developed in the larger mine, a 5000-ton-a-day quarry-like operation. Only the richest 70 ft of the bed, averaging 29 gal of oil to the ton, will be mined at the outset.

Shale is trucked 5½ miles down the mine road to the plant, where it is crushed, heated to drive off the oil and the products refined. A truck-dumping hopper, crusher, belt conveyor, screening equipment, weightometers and storage bins are provided. Two *N-T-U* batch retorts, with firebrick lining and a capacity of 40 tons each, have been installed for the initial experiments and a contract awarded for the refinery. At the outset, the plant will process 80 tons of shale a day. The oil-storage system consists of six 65-barrel rundown tanks and four 250-barrel storage tanks.

Power is obtained from the Public Service Co of Colorado and water from the Colorado River. Nearly 21,000 ft of 5- and

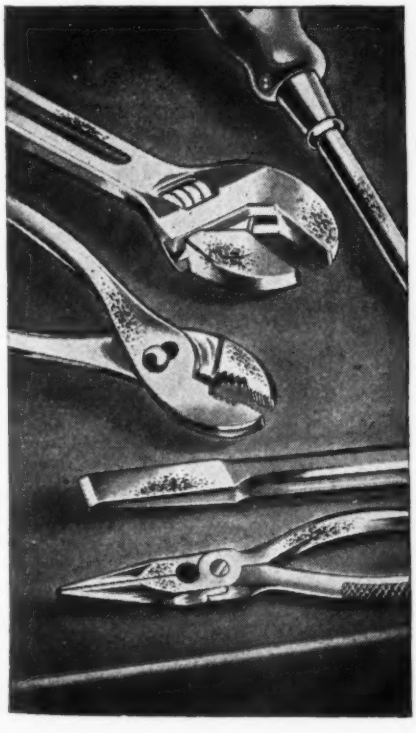
# $100,000 Worth of Hand Tools saved from "RUST"

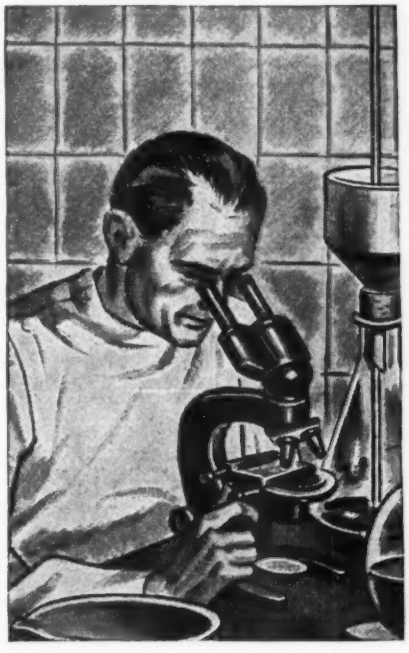
## NEW PRODUCT DOES THE JOB AFTER PLANT CONDUCTS EXHAUSTIVE TESTS

**Lubrication Engineer's Report**

"Some time ago, we were called in by a prominent manufacturer.* Corrosion of all metal parts in his entire plant had gone out of control. The machine shop and hand tools, valued in excess of $100,000, were a sorry looking 'dusty-brown.' Everything they had used in the way of rust preventives heretofore failed to solve their difficulty.

"After studying their problem we recommended our General Purpose Anti-Corrode No. 100 and suggested that they give it exhaustive tests. Their chemist did so and we are happy to report that it solved their problem.





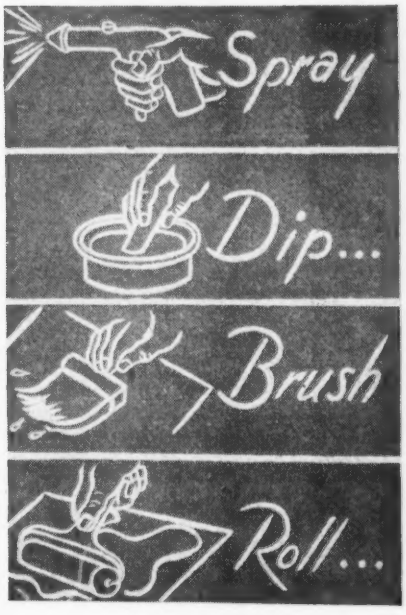
**Used on Hand Tools As Well**

"They have since used over 150 gallons of this Anti-Corrode on everything metal in their plant, including small hand tools such as pliers and screw drivers."

Anti-Corrode No. 100 is one of several new types of Cities Service protective coatings for metals. Designed to prevent corrosion of raw stocks, finished parts and completed machines, it adheres firmly, displaces moisture and protects longer than many materials now on the market.

**Easy To Apply**

Apply Anti-Corrode by ordinary work-shop methods. Spray, dip, brush or roll it on. The protective film is continuous and non-porous—does not break at sharp edges nor rupture on flat surfaces. It need not be removed from metal to be stamped, drawn or otherwise formed.




**Write For Demonstration**

Cities Service will demonstrate the many advantages of Anti-Corrode to you in your own plant. Contact the branch office nearest you or write Cities Service Oil Co., 60 Wall Tower, New York 5, N. Y.

*Name on request*

**Cities Service means Great Service**

CITIES SERVICE

Cities Service Oil Co. NEW YORK · CHICAGO

Arkansas Fuel Oil Co. SHREVEPORT, LA.

*(This offer available only in Cities Service marketing territories East of the Rockies.)*

CITIES SERVICE OIL COMPANY
SIXTY WALL TOWER
NEW YORK 5, N. Y., ROOM 145

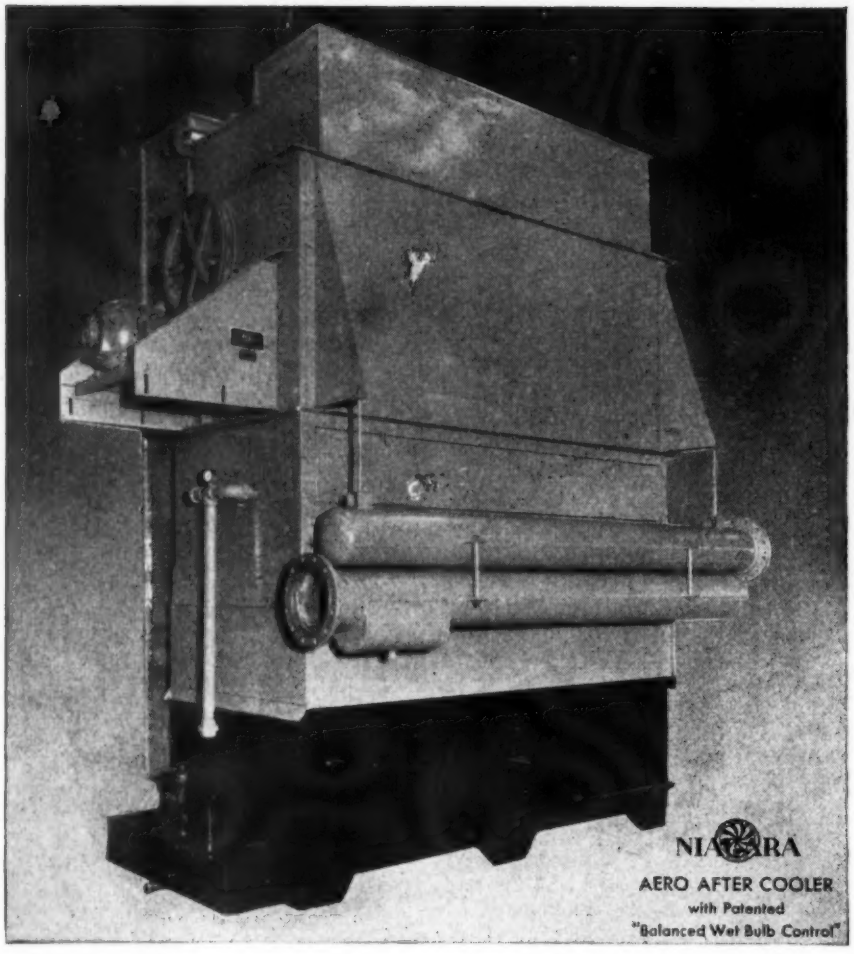
Gentlemen: I'd like to test ANTI-CORRODE No. 100 on my own equipment FREE OF CHARGE. Send me details.

NAME .....

COMPANY .....

ADDRESS .....

CITY ..... STATE .....




## Save expensive "wear out" of air tools

● Water in compressed air lines is more than a nuisance; its cost is thousands of dollars yearly in worn-out tools and equipment, or broken air tools caused by water hammer, abrasion and washed-out lubricants.

Protect your air tools and compressed air processes with drier compressed air . . . using the NIAGARA AERO AFTER COOLER. Based on the evaporative cooling principle, it always keep the air in compressed air lines below the relative surrounding temperature, preventing condensation and, under the least favorable conditions, provides air with one-third to one-half the moisture content of water-cooled air.

Water savings will pay for the installation. Write for Bulletin 98-P.

**NIAGARA BLOWER COMPANY**

*Over 30 Years of Service in Industrial Air Engineering*

405 Lexington Ave. New York 17, N. Y.

*Field Engineering Offices in Principal Cities*

INDUSTRIAL COOLING HEATING • DRYING

NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

6-in. pipe were laid for the water system, and three 43,000-gal storage tanks installed.

The demonstration plant will be operated in close collaboration with the Bureau's oil-shale research and development laboratory on the campus of University of Wyoming at Laramie, where processes are under study with laboratory and pilot-plant-scale equipment. Promising developments in the laboratory will be tested at the demonstration plant to determine their commercial significance.

During demonstration operations, accurate cost records will be maintained at each stage of the production of shale oil and its byproducts—fuels, waxes and possibly lubricants. Definite cost figures will be developed for mining, retorting and refining operations so private industry may determine when shale oil becomes competitive with petroleum and ready for development. With costs of discovering natural petroleum constantly rising, it is anticipated that manufacture of synthetic liquid fuels from coal, oil shale, or other materials may become feasible within a few years.

Contrary to expectations, demand for petroleum already has passed the peak reached during the war. Bureau officials predict a continuing rise in years to come to meet increasing automobile, airplane, diesel engine, industrial and household requirements. For several years, discoveries of oil in new fields have not kept pace with consumption. The present output of known domestic fields cannot be increased substantially without irretrievable loss of oil, for the wells are now at or near their maximum efficient rate. Replacement by synthetic processes of any large segment of natural petroleum production will require many years of conversion and construction. Therefore, authorities agree that the work prerequisite to such replacement cannot wait until the need arises.

---

**Diesel Engine Manufacturers Assn** held a chief engineers' session on May 21 at Cleveland, Ohio, on such topics as cooperation with national engineering societies, fuel oils and crankcase explosions. Another meeting will be held in Dec on piston scuffing, altitude ratings and metallurgical problems.

**Warren Steam Pump Co** is celebrating its fiftieth anniversary. In 1897 this company had its humble beginning, sponsored by former skilled Knowles Co workers and a group of influential citizens. Reciprocating pumps were the sole product of the company for several years. In 1902, the first section of what is now the main machine shop was built. Additions have been made from time to time until this unit is now nearly 700 ft long and contains modern facilities for production of reciprocating and centrifugal pumps, a complete line of the latter having been added in 1924.

**Industrial Instrument Service Co** announces incorporation of its business under name of Industrol Corp. Company has expanded its facilities to include engineering and fabrication of process control systems and assembly of completely wired and piped instrument panels.

STYLE NO. 375

# R/M BRAIDED ASBESTOS ROPE

The doors on furnaces, gas generators, and many other types of equipment require a dense, strong packing that will resist temperatures up to 600° F. and furnish a tight seal.

To meet these conditions, and as a variant from ordinary braided asbestos packing, R/M engineers designed the asbestos rope shown above. It is furnished either in solid braided construction without a center core, Style No. 375; or with a single or double braided asbestos jacket over a twisted asbestos rope center, Styles No. 371 and 372 respectively. All types are available either treated or dry, ready for oiling and graphiting in the engine room to the user's specifications.

These different types of braided asbestos ropes are just a few of the hundreds of R/M packings which are available through your authorized R/M distributor. For every type of equipment, for every service, R/M has a specially engineered packing of selected materials and of proved performance.

**RAYBESTOS-MANHATTAN, INC.**

*ASBESTOS TEXTILE & PACKING DIVISION*

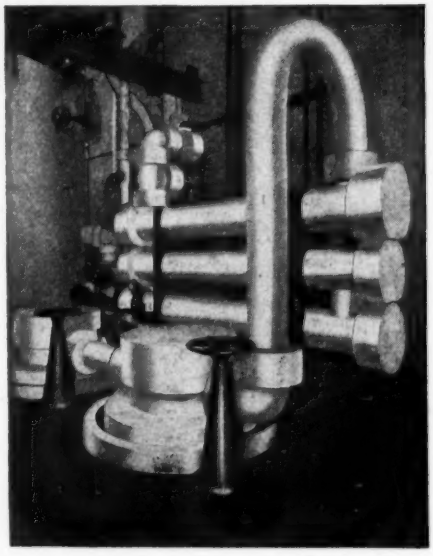
**Manheim, Pa. • Bridgeport, Conn.**
**North Charleston, S. C. • Passaic, N. J.**

RAYBESTOS R M MANHATTAN

R M

***It's "Packed with Satisfaction" when you use R/M***

# CLEAN STEAM means SAVINGS



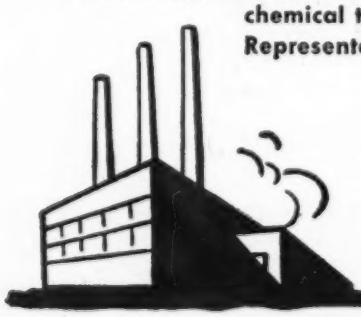
# HENSZEY

## CONTINUOUS BLOWDOWN

***effectively controls boiler water concentration to prevent carryover into steam lines.***

**Remember . . . CLEAN STEAM contributes to longer boiler life . . . makes packings last longer . . . reduces wear on rods and cylinders . . . reduces turbine blade erosion . . . keeps tube burns at a minimum . . . prevents superheater burnouts . . . prevents sticking of reducing valves, traps, etc.**

**So for continuous, automatic boiler water concentration control in EXISTING or PLANNED power plants, consider Henszey Continuous Blowdown . . . the time proved system that prevents priming, foaming, and the formation of sludge and scale (with proper chemical treatment). Call your nearest Henszey Representative or write to**



**HENSZEY COMPANY**
DEPT. D7 • WATERTOWN, WISCONSIN

**HENSZEY**

## CONTINUOUS BLOWDOWN *and* BOILER PLANT SPECIALTIES

**Boiler Feed Regulators • Distillation Systems • Heat Exchangers**
**Feed Water Meters • Flow Indicators • Proportioning Valves**
**also MILK EVAPORATORS and PREHEATERS**


## Radiant Cooling Study Described at ASHVE

An experimental study of physical, physiological and comfort aspects of radiant cooling was described by Prof C P Yaglou, of Harvard School of Public Health, at the April meeting of the New York chapter of American Society of Heating and Ventilating Engineers.

Objective of tests described by the speaker, and conducted by him and Dr Oscar Schneider some years ago, was to determine whether comfort could economically be maintained with high summer temperatures and humidities and without entrance and exit "shock." Tests were carried out in a small wall-cooled room, built inside a larger room which was conditioned by conventional method. Chilled water, in some cases near freezing, was circulated through coils embedded in three of the walls of the experimental room. The tests were run with dry-bulb air temperatures between 75 and 95 F and with relative humidities between 40 and 70%. Subjects entered the wall-cooled cubicle from the outer "hot" room which had no cooled walls; they remained in the cool room for two or more hours and then returned to the hot room. Skin and clothing surface temperatures were recorded at 23 points and various other measurements were made.

With air at 75 F, mean wall temperature required to produce comfort in men wearing warm-weather clothing was about 75 F, Prof Yaglou stated. As air temperature was increased, required mean radiant temperature had to be lowered to 65 F. Mean temperature of the cooled walls was then 40 F and temperature of the water circulating through the coils was about 35 F. With cubicle temperatures of about 89 F for men and 92 F for women, air temperature had no effect on comfort because mean "clothing" surface temperature approached air temperature.

For women, as compared with men, consistently higher (2 or 3 deg) wall and air temperatures produced comfort, partly because of lower metabolic rate and partly because of considerably lower weight of clothes worn by women.

---

**Johns Hopkins University** announced that International Nickel Co has established a graduate fellowship for $1900. It will be awarded for the first time in Sept 1947. This fellowship is open to graduate students in engineering and may be held for two consecutive years, during which the recipient will devote himself to study and research on developments in properties and applications of nickel, copper, platinum, or alloys containing any of these metals. While working on his chosen research problems, the recipient can be completing courses for an advanced degree. The fellowship will be most applicable to work of students in mechanical, chemical or electrical engineering. International Nickel Co is donating to the university library literature on the metals and alloys it produces. Send applications for this fellowship for the year 1947-48 to *Dean of Engineering, Johns Hopkins University, Baltimore* 18, *Md.*, by July 1, 1947.

# How faithful

# are your

# "faithful" old pumps

There comes a time in the life of *everything mechanical* when it is no longer profitable to keep it in operation. Time takes its toll in fatigue, wear and obsolescence.

### Pumps are not exceptions

Old pumps may continue to run and give "satisfactory" service. However, tests usually show a steady decline in efficiency, a steady rise in power requirements and maintenance costs.

If your pumps are not giving the service you now expect, or your pumping requirements have increased, it is time to talk with a Warren representative. Write to us or to our nearby office.

**WARREN STEAM PUMP COMPANY, INC.**
**Warren, Massachusetts**

***For continued high efficiency, low power consumption, low maintenance costs · · · replace with***

# Warren Pumps

**CENTRIFUGAL AND RECIPROCATING**

Atlanta Boston Chicago Cleveland Denver Detroit Houston Manchester, Conn. Los Angeles Minneapolis New Orleans New York Philadelphia Pittsburgh Richmond San Francisco Seattle St. Louis

P-12

## EXTRA SERVICE

# "STANDCO"

**PILLOW BLOCKS**

There's Extra Value in these rugged, well-designed Standco Pillow Blocks with their life-long, trouble-free service.

They, are fully able to "take it," and have babbitted, accurately broached bearing surfaces, with faces machined to a "T". Easy to clean, easy to lubricate.

***Write for Bulletin***

**"Unbrako" and "Hallowell" Products are sold entirely through Industrial Distributors**

*Over 44 Years in Business*

**STANDARD PRESSED STEEL CO.**

**JENKINTOWN, PENNA., BOX 577**

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# HERCULES

SEAMLESS COPPER

# FLOATS

**GUARANTEED**

**TO STAND UP!**

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degree temperature.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service. Insure carefree maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

**HERCULES FLOAT WORKS**

200 Franklin St.

SPRINGFIELD, MASS.


## APPOINTMENTS

**Westinghouse Electric Corp** has named Karl S Kramer assistant manager of general-purpose turbine section and John C Spahr assistant manager of industrial turbine section of steam div. William B Anderson has been made manager of aviation gas-turbine div, succeeding George H Woodard. J H Jewell has become manager of apparatus sales.

Election of Ivan F Baker as vice-president of **Westinghouse Electric International Co** has been announced.

**Peabody Engrg Co** has appointed W L Byler advertising manager.

F Q Wilson has been made Cincinnati district manager of **Elliott Co.**

John B Ives has been appointed manager of operations of **Laclede-Christy Clay Products Co.** He will have complete charge of manufacturing and mining operations of Laclede-Christy St. Louis and Toledo plants and mines. Paul J Maddox has been named general sales manager of refractories div.

**Allis-Chalmers Mfg Co** elected Walter Geist for his sixth term as president. All directors and officers of the firm were re-elected at the annual meeting of stockholders and board of directors. J I Onarheim has joined staff of central station and marine sales dept. In his new post, Onarheim will assist product departments and district offices in promotion and coordination of sales activities with utilities and municipalities. Joseph E Kerwin has joined the patent dept.

J R Warford has been appointed special representative in the U. S. to head a newly created wax section in **Sun Oil Company's** industrial products dept. George W Mock, technical representative for wax products, will be associated with Warford.

**Liquid Conditioning Corp** announces appointment of William A Krebs as engineering and sales representative in the district including Philadelphia, counties in Pa. close to Philadelphia, southern N. J. and state of Del. He will handle sales of *Liquon* equipment for all water-treatment and liquid-conditioning processes and *Liquonex* zeolites of all kinds. Krebs headquarters are at 1424 Land Title Bldg, Philadelphia 10, Pa. Vincent J Calise has joined the organization as technical manager.

Glenn B Warren succeeds Arthur R Smith as managing engineer of turbine-generator engineering div of **General Electric Co.** Smith retired May 1 after a 50-year career in the electrical industry. George W Hopkins has been made Great Lakes district representative for GE wiring devices. Floyd M Shumway and R S Oschner have been named North Central district representatives of accessory equipment products, and tungar and metallic rectifiers, respectively. Eugene C Stewart has been made assistant manager of New Kensington

# A MERCOID

## UNFAILING ADVANTAGE

Whatever your control requirements may be, it is conceded that the switch in a control warrants first consideration, due to its functional characteristics. All Mercoid Controls are equipped exclusively with hermetically sealed mercury switches of special design and selected materials.

Mercoid mercury switches are known the world over for their dependable service. They are not affected by dust, dirt or corrosion; nor are they subject to open arcing with its attendant consequences of pitting, sticking or oxidized contact surfaces, all of which, are likely to interfere with normal switch operation.

That is why among other things, Mercoid Controls on the whole give you assurance of better control performance and longer control life—a distinct and unfailing advantage—the reason why they are also the choice of America's leading engineers for many important industrial applications.

*MERCOID CONTROLS are available in a variety of types for sensitive control of Pressure, Temperature and Lever actuation.*

MERCOID
APPROVED CONTROLS

THE MERCOID CORPORATION
4201 BELMONT AVENUE • CHICAGO, ILLINOIS

*Showing wheel construction used in four large Clarage fans now operating in one of the mills of Inland Steel. Each fan handles hot gases and abrasive dusts at 550° F. They had to be good — and they are!*

# *Built* **HEAVY** *Where the Strains Come*

**It's our policy to build Clarage equipment HEAVIER than common practice. From the customer's standpoint, we've found that it always pays.**

**That's why Clarage fans will take a lacing day after day, year after year, on your most difficult jobs without performance failure.**

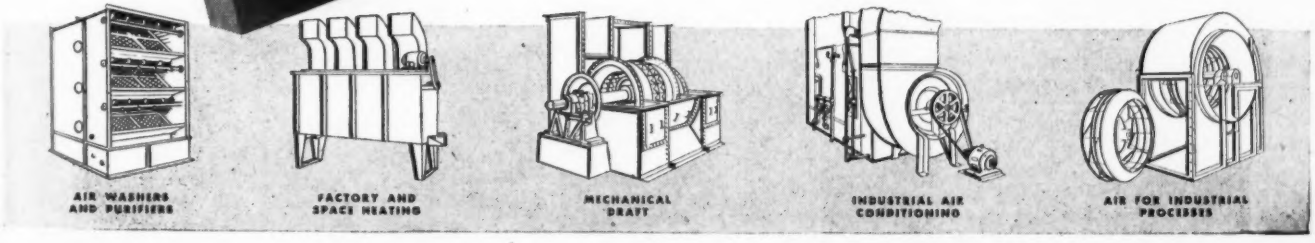
**Yes, to see Clarage FIRST for air handling and conditioning equipment is invariably a wise and profitable move.**

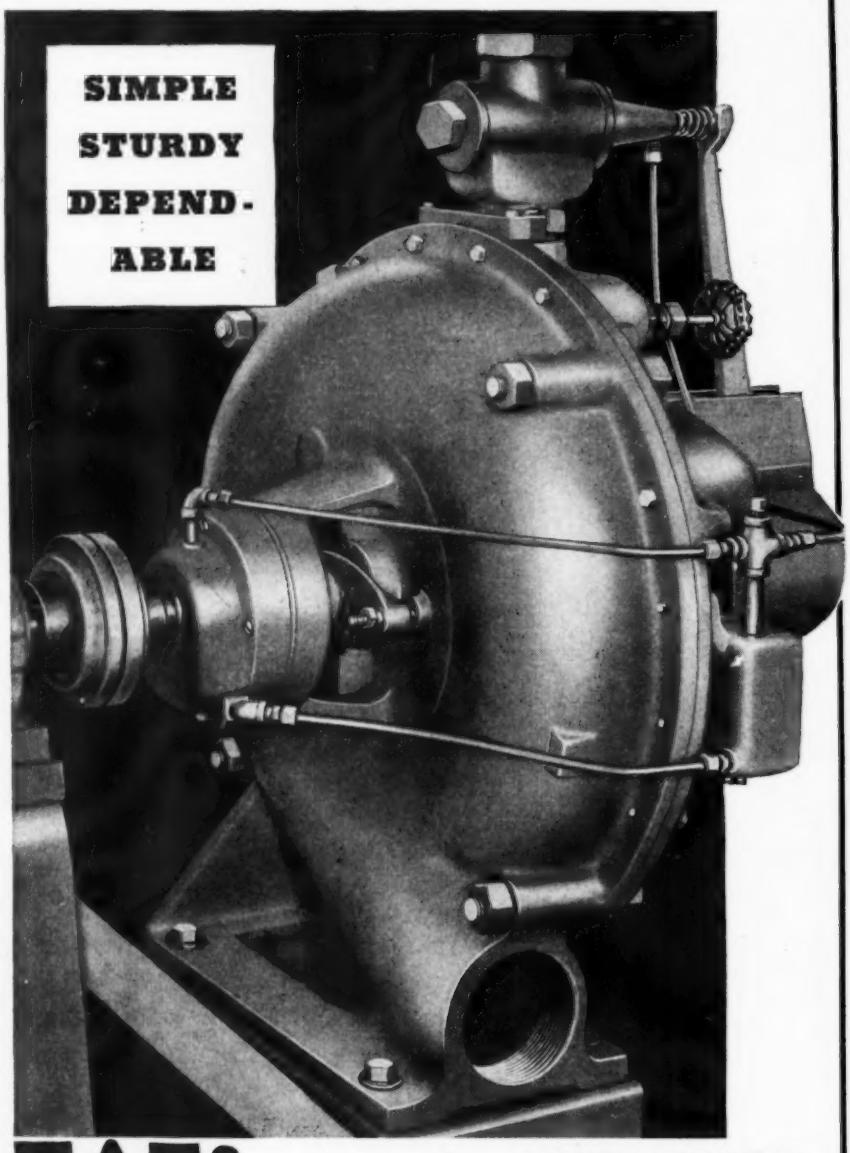
**Clarage**

**—HEADQUARTERS FOR AIR HANDLING AND CONDITIONING EQUIPMENT**

**CLARAGE FAN COMPANY**
**KALAMAZOO, MICHIGAN**

***APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES***






# Wing AUXILIARY STEAM TURBINES

**FOR DRIVING FANS, BLOWERS, PUMPS, COMPRESSORS, GENERATORS, STOKERS, WINCHES, etc.**

**FEATURES:**

CAPACITIES—up to 150 h.p.

SPEEDS—up to 4,000 r.p.m.

Capable of Exhausting against HIGH BACK PRESSURES

SHAFTS—Horizontal or vertical

ROTATION—Clockwise or counter-clockwise

LUBRICATION—Wing Filtered Oil Lubricating System or Grease

GOVERNOR—Overspeed trip and Speed Regulating

OIL-FREE EXHAUST STEAM may be used for heating or process work.

*Write for Bulletin*

**L. J. Wing Mfg. Co. 50 Seventh Avenue, New York 11, N. Y.**

Factories: Newark, N. J. and Montreal, Canada

TURBINE BLOWERS • TURBINES • • FANS • MOTOR DRIVEN BLOWERS

REVOLVING UNIT HEATERS • UTILITY HEATERS • FIXED DISCHARGE UNIT HEATERS

DUCT FANS • DRAFT INDUCERS • HEATER SECTIONS • SHIP VENTILATORS • FOG ELIMINATORS


Works. W J Campbell has become GE arc-welding specialist for Southeastern district, with headquarters in Atlanta, Ga. Campbell covers N. C., S. C., Tenn., Ga., Fla., Ala., Miss., and part of La. Homer A Rawson has been appointed sales manager of GE lighting components.

**Weston Electrical Instrument Corp** has announced election of following officers: (1) Edward F Weston, chairman of board (2) Caxton Brown, chairman of executive committee (3) Earl R Mellen, president (4) H Leigh Gerstenberger, vice-president in charge of sales (5) Reginald R Lambe, vice-president in charge of manufacturing (6) John H Miller, vice-president and chief engineer (7) Ross Nichols, secretary and treasurer (8) F G Hawthorne, comptroller and assistant secretary.

R W Kerr was made executive vice-president of **Plomb Tool Co.** H C Baumgartner was elected secretary and treasurer. Other officerships confirmed at the meeting of board of directors include: M M Mautner, vice-president in charge of industrial relations; C W Coslow, vice-president in charge of manufacturing; F G Robbins, vice-president in charge of research and development; and J P Danielson, vice-president in charge of J P Danielson Div.

**W B Connor Engrg Corp** announces that Patrick J Shea has become associated with the organization. He is expected to travel extensively in promotion of *Dorex* air recovery.

Richard M Lawrence, of Wilmington, Del., has been added to staff of development dept of **Monsanto Chemical Co.** He will specialize in market research work. F A Abbiati has been appointed assistant general manager of plastics div, Springfield, Mass. Abbiati is to be succeeded as general manager of sales by James R Turnbull, who had been assistant general manager of sales. Turnbull, in turn, will be succeeded by Charles Lichtenberg. Other changes are following: Robert K Mueller became assistant production manager of East Plant; Kenneth M Irey has been named plant manager of East and West Plant; and W T Dickens has been appointed assistant plant manager of both plants.

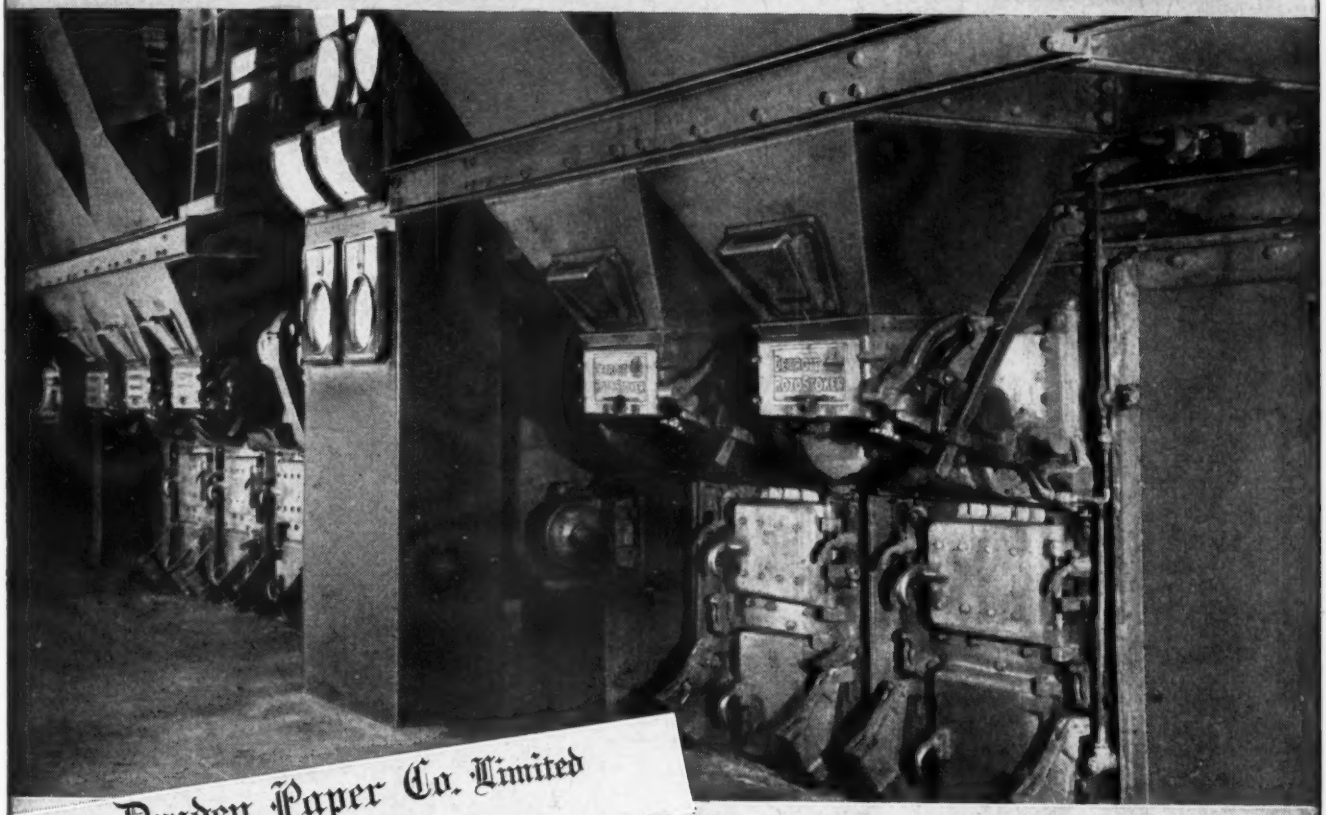
**Monsanto Chemical Co** names Irby L O'Brien assistant general traffic manager. Lester A Pratt has been made assistant to Josiah B Rutter, Merrimac Div general manager.

Roy W Maze has been appointed public relations director of **Marley Co.** Maze succeeds Charles B Briggs Jr, who is now production manager of Kansas City, Kan., plant.

**Babcock & Wilcox Co** has elected Anthony M Kohler and Alan E Phin as vice-presidents.

**Caterpillar Tractor Co** announces that news service, formerly a div of advertising dept, has been combined with sales publications div of general sales dept, under direction of Burt Powell, sales publica-

# DRYDEN PAPER
# — Repeats —
# THREE INSTALLATIONS
# DETROIT ROTOSTOKERS

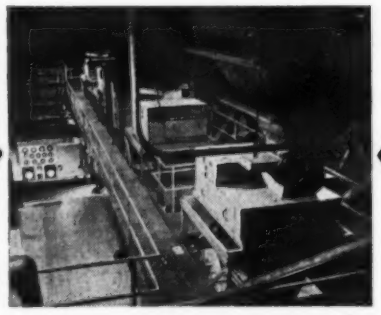


## DETROIT STOKER COMPANY

Fifth Floor, General Motors Building, Detroit, Michigan • Works at Monroe, Michigan
District Offices in Principal Cities • Built in Canada at London, Ontario

## Keep your boilers at their best
## Keep them constantly on test

Four Richardson Scales, mid-section supported, weighing coal from overhead bunkers to pulverizers.



**WEIGH** *all coal accurately on Richardson Automatic Coal Scales*

The password to big operating economies and top efficiencies from boiler batteries is "coal-control"—through the use of Richardson Automatic Coal Scales. Safeguarded by continuous readings of coal consumed by each boiler as provided by these scales, you can determine and compare amounts of steam generated per pound of coal. You can spot losses at their very source . . . *quickly.*

Big, medium, and small concerns *(Richardson Automatic Coal Scales meet varying plant requirements)* report sizeable amounts of money saved when boilers are kept constantly on test the Richardson way.

Act today. Eliminate guesswork on boiler efficiency—check it right—by weight. Write for Bulletin No. 1143.

**RICHARDSON SCALE COMPANY, Clifton, N. J.**
ATLANTA • BOSTON • BUFFALO • CHICAGO • MINNEAPOLIS • WICHITA
NEW YORK • OMAHA • PHILADELPHIA • SAN FRANCISCO • DETROIT • PITTSBURGH • MONTREAL • TORONTO

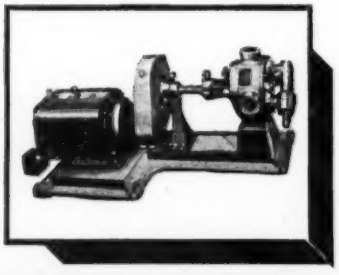
IF YOUR MEN ARE FORCED TO STAND AROUND LIKE THIS - BECAUSE YOUR PUMPS ARE SLOW AND INEFFICIENT . . . .

**THEN DON'T WASTE TIME!**

***Investigate***

## VIKING ROTARY PUMPS
## Today!

It's Viking for fast and positive delivery, self-priming, no pulsation, dependable long life.



Write for special Bulletin Series 46SW. It will be sent to you by return mail.

See Our Catalog In SWEETS

**VIKING PUMP COMPANY**
CEDAR FALLS, IOWA


tions manager. Jerry Reichart continues as news editor. Wendell J Farischon continues to assist the news editor. Fred J Tuerk and J C MacMillan have been added to the staff, along with additional clerical assistants. Gordon W Monfort has resigned as director of news service.

George M Schurman was elected a director of **American Brake Shoe Co.** Homer Parsons has been appointed director of exports. Kempton Dunn was elected secretary. Sumner T McCall, former vice-president and secretary, retired from active service on June 1. He has been associated with the company since 1910. Cyrus E Brush was elected an assistant secretary, to serve with Samuel S Drury Jr, also an assistant secretary.

Thomas H Beacom was elected to **Stewart-Warner Corp** board. He fills vacancy caused by retirement of Robert J Dunham because of failing health.

**Mathieson Alkali Works** has appointed H Webster Stull as director of personnel, a newly created position.

J H Scott, 823 Commerce Bldg, Rochester 4, N. Y., has been made a sales representative by **Gibson Electric Co,** Pittsburgh, Pa. His territory will cover Watertown and Binghamton, N. Y., as well as all of New York State west of these cities. W M Hicks, 41 Park Row, New York, N. Y., has been named a sales representative. His territory will cover the New York metropolitan area and includes northern N. J.

**Progressive Welder Co** opened local sales and sales engineering offices at 578 Maccabees Bldg, Detroit, Mich. The new office, to be known as Progressive Welder Sales Co, is headed by Harry S Rose. Douglas K Renny, Douglas I Harris and Thomas J Crawford will be associated with Rose.

Jack York Hewitt has been named sales manager of *Miracula* and *Gemco* air conditioner divisions of **General Engrg & Mfg Co.** Frank D Klein has been made assistant sales manager of air conditioner div.

**Ampco Metal, Inc,** announces appointment of J B Ripley Brass Foundry, Windsor, Ver., as its licensee in that area. Ripley organization will cover Ver. and N. H.

Brig Gen Hugh C Minton became production manager of **Koppers Co.**

**Blaw-Knox Co** has appointed Loring Phillips as market research analyst.

J Lester Perry has been elected president of **Columbia Steel Co,** U. S. Steel's West Coast subsidiary, succeeding the late William A Ross.

**Farris Engrg Corp** announces appointment of Paul Robinet as sales manager.

Edgar F. Schaefer was elected president of **Gardner-Denver Co.** H G Myers became chairman of the executive board. L L Lawrence has been appointed manager of branch office in Boston. A H Jones has

# Here's what you can do with this Blowpipe . . .

. . . and, by selecting from a choice of 57 different nozzles you can use the OXWELD C-32 to do almost any metal-cutting job practicable with manual equipment.

This sturdy cutting blowpipe is easy to handle and is built to give years of economical service even under the most strenuous conditions of use. A specially designed mixing chamber provides high flashback resistance. The C-32 operates on medium-pressure (5-15 lb. per sq. in.) acetylene.

Write for a catalog or ask Linde to demonstrate the advantages of this blowpipe.

The word "Oxweld" is a registered trade-mark of Union Carbide and Carbon Corporation.

**THE LINDE AIR PRODUCTS COMPANY**

*Unit of Union Carbide and Carbon Corporation*

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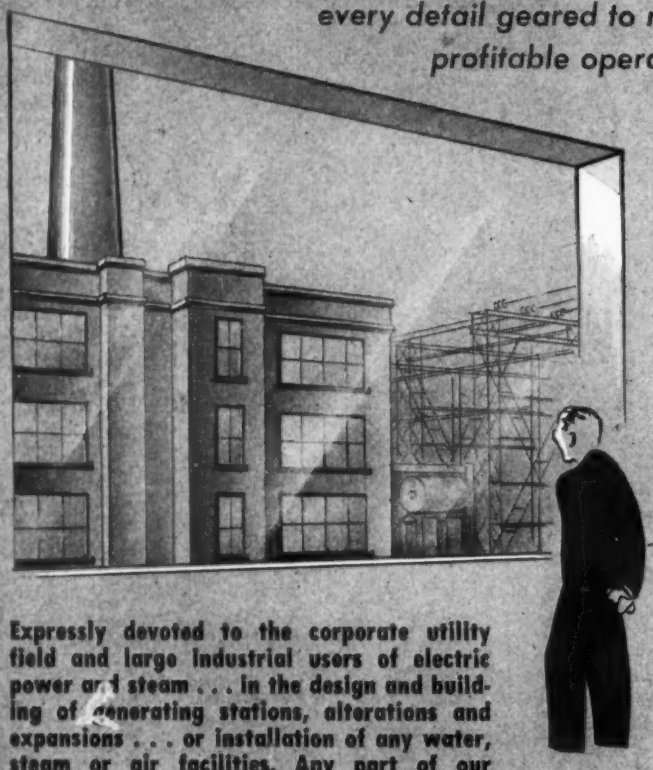
In Canada: Dominion Oxygen Company, Limited, Toronto

# COST CONSCIOUS?

## Then PRITCHARD Services to UTILITY and INDUSTRIAL Power Plants are for you.

**DESIGNING • ENGINEERING**
**CONSTRUCTION • PIPING**

**Complete Plants • Additions • Installations . . .**
*every detail geared to more profitable operation*



**Expressly devoted to the corporate utility field and large industrial users of electric power and steam . . . in the design and building of generating stations, alterations and expansions . . . or installation of any water, steam or air facilities. Any part of our thorough service, from an economic study to a finished plant, is available separately.**

**POWER DIVISION • FIDELITY BLDG. • KANSAS CITY, MO.**

**J.F. Pritchard & Co.**

**ENGINEERS • CONSTRUCTORS • MANUFACTURERS**

**for the CHEMICAL • PETROLEUM • GAS and POWER industries**

**Houston • Tulsa • Pittsburgh • Chicago • New York • Los Angeles**
**St. Louis • New Orleans • Memphis • Philadelphia • Baltimore**

*See Sweets' Files and Other Industrial Catalogs for full information on Pritchard Services and Equipment, or write or phone nearest office.*


been made director of export office in New York City. Jones was also elected vice-president of newly formed Gardner-Denver Western Hemisphere Co, with offices in New York.

**Corning Glass Works** announces formation of an Eastern sales district for technical products div. Charles L Day will manage the new sales district, with main offices in New York City.

William Mohr has been made regional manager in Caribbean zone for **Borg-Warner International Corp.** John Gulick has been named Chicago office manager. In addition, Gulick will direct overseas sales activities for automotive products of R N Nason & Co, whose exports are handled by Borg-Warner International Corp.

**Borg-Warner Corp** elected George P F Smith a vice-president. Smith is also president of Marbon Corp, a Borg-Warner subsidiary.

Walter M Reynolds has been appointed controller of Ithaca, N. Y., and Detroit, Mich., plants of **Morse Chain Co.**

Gordon S Hughes has been made merchandising manager of fixture div of **Sylvania Electric Products Inc.**

R H Kutscher has been appointed manager of Pittsburgh sales territory of **Electric Machinery Mfg Co.** He succeeds H L Renking, who became district manager of Southwestern territory, with headquarters at Dallas, Tex. E-M's Pittsburgh office is at 355 Fifth Ave.

**Mason-Neilan Regulator Co** has named John W Brown manager of its San Francisco office at 198 2nd St.

Harry W Griffith has been appointed field engineer for Spang-Chalfant Div of **National Supply Co.** His headquarters will be at Caracas, Venezuela.

L J Amsdell has been promoted to Eastern sales manager of **Acme Rubber Mfg Co.** He will make his headquarters at company's New York offices in Woolworth Bldg, 233 Broadway.

**Pittsburgh Consolidation Coal Co** has named Dr Howard S Turner as assistant director of research and development div, with offices at company's research center at Library, Pa.

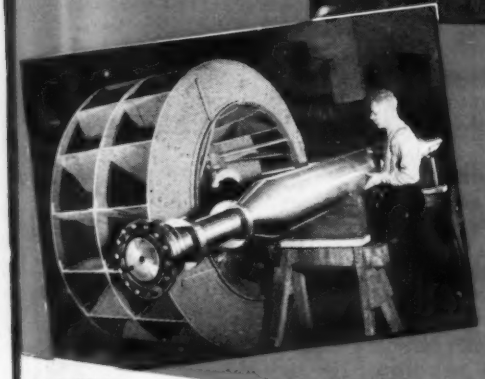
**Thermoid Co** has named Henry E Holden and Louis Benton as original equipment sales engineers for industrial friction material. Holden will operate in Mich. and Ohio area, with headquarters at 17830 Cannon Ave, Cleveland. Benton will have charge of Ind., Ill. and Wis. area, with headquarters at Chicago office.

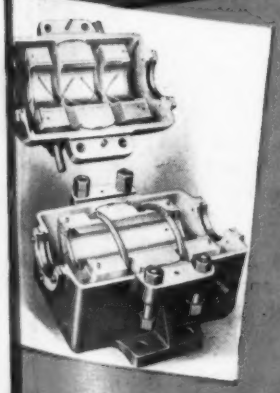
W J Creighton retires from office of executive vice-president of **Jones & Laughlin Steel Corp,** but continues in an active advisory capacity as consultant to chairman of board of directors. He also continues to be a director and member of

# BUILT UP to STAND UP!

*Right:* "Buffalo Induced Draft Rotors are built for punishment . . . extra heavy-gauge plates and blades hot-riveted together.

*Below:* Husky, massive, precision - built rotors and shafts mean long, economical service on your draft jobs.





*Left:* Bearings are self-aligning and water cooled . . . adequate in every respect for smooth running with minimum friction.

Induced Draft Fans that stand up far longer under the continual erosion of fly ash and persistent action of gases! "Buffalo" has been building Induced Draft Fans like this for a good many years—and scores of these have been on the job for *decades* with very little time out for repairs.

"METAL WHERE IT COUNTS." Yes, "Buffalo" Induced Draft Fans are "built up" at all points where we *know by experience* excess wear will occur. A look at the rotors, shaft and bearing at left will show you what we mean by "built up to stand up."

ACCESSIBILITY OF PARTS. When a part finally *does* wear out, minimum time is lost in replacing it . . . for all parts are readily accesible.

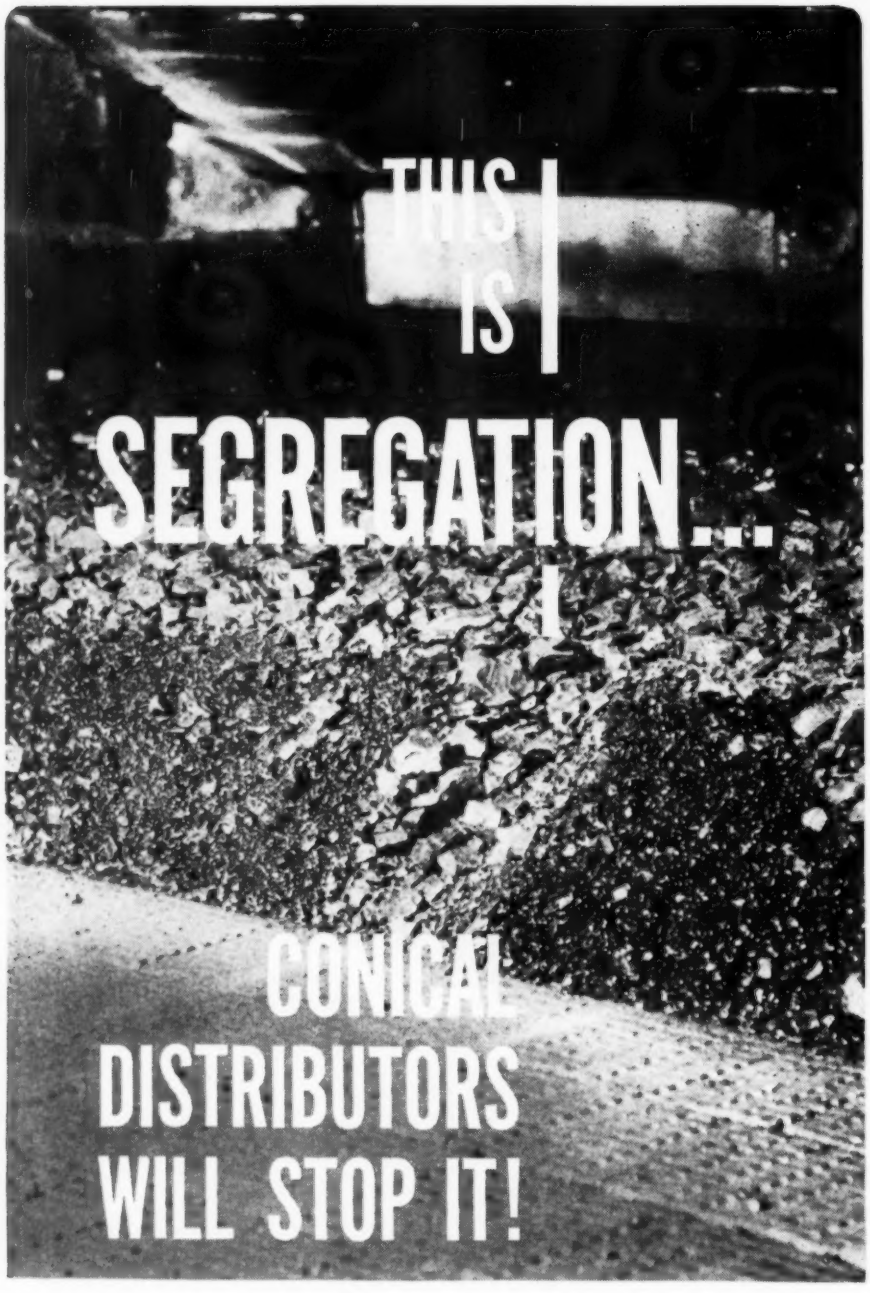
EFFICIENCY. As in all "Buffalo" Fans, these Induced Draft Fans have precision-balanced rotors and properly formed blades and housings to give maximum efficiencies. *Ask your local "Buffalo" representative for complete data, or write:*

**BUFFALO FORGE COMPANY**

488 BROADWAY BUFFALO, N. Y.

*Canadian Blower & Forge Co., Ltd., Kitchener, Ont.*

"Buffalo" **DRAFT FANS**




*In order to obtain the above photograph, coal was run onto a chain grate stoker and then the coal in the foreground was carefully removed. Photograph is taken inside the boiler looking toward the stoker hopper.*

Note that the coarse streak of coal shows a definite separation or *segregation* from the finer coal on each side. Where this condition exists fuel is wasted, boiler efficiency is materially reduced and arches require far too frequent attention.

CONICAL Non-Segregating Coal Distributors deliver coarse and fine coal in uniform mixture across the stoker hopper. Combustion is uniform—no "hot spots" or smothered areas in the fuel bed. The result is higher boiler efficiency, lower fuel consumption and less stoker arch maintenance.

For particulars on CONICAL Non-Segregating Coal Distributors, write to STOCK ENGINEERING COMPANY, 715 HANNA BUILDING, CLEVELAND 15, OHIO

STOCK
ENGINEERING CO.

★
CONICAL
Non-Segregating
Coal Distributors
★
S.E.CO.
Coal Valves and Coal Scales

executive committee. Frank R Denton, a newly elected director, has also been elected a member of executive committee. C L Austin, a director and treasurer, was elected to additional offices of member of executive committee and vice-president. H Parker Sharp, a director and general counsel, was elected to offices of executive committee member and vice-president. V H Lawrence was made a vice-president. W R Elliot has succeeded V H Lawrence as general superintendent of Otis Works. W H Dupka, controller, was elected to additional office of vice-president. H W Graham, director of technology, was named a vice-president. W Randall Compton has been appointed assistant to the president. W C Plummer, attorney of the corp, was appointed to additional office of assistant secretary.

**Bailey Meter Co** announces assignment of three engineers to company's branch offices: R L Stewart reports to Denver, L E Bartel to Kansas City, G D Williams to Atlanta.

Rudolph E Reimer, secretary and treasurer of **Dresser Industries, Inc,** was also elected a vice-president.

**Bird-Archer Co** has appointed John H Carter Co, 5600 Tchoupitoulas St, New Orleans, as its representative in La., southern Ark., eastern Tex. and southern Miss. L T Stevens directs a branch office of the Carter organization at Shreveport, La.

Fred C Boyce was re-elected president of **D J Murray Mfg Co.** M P McCullough was named vice-president; C E Staky, executive vice-president and general manager; A W Plier, secretary and assistant general manager; J S Alexander, treasurer. The directors elected, in addition to Boyce, McCullough, Staky and Alexander, are D C Everest, G L Ruder and Grover Keeth.

**Carborundum Co** announces appointment of Clarence E Hawke as director of domestic sales, Edwin B Forse as manager of refractories div at Perth Amboy, Boyd H Johnson as manager of refractories sales at Perth Amboy and Russell G Albertson as div manager of Canadian Carborundum Co, Ltd, Niagara Falls, Ont., Can.

**Arma Corp** has promoted Herbert C Guterman to president. Guterman succeeds Arthur P Davis, who remains as a director and engineering consultant.

Herman C Hesse has been named professor of mechanical engineering at **Illinois Institute of Technology.**

**Van Valkenburgh, Nooger & Neville, Inc,** engineers at 15 Maiden Lane, New York, N. Y., have appointed Robert D Slack project director.

Leroy F Marek has been elected vice-president of **Arthur D Little, Inc.**

**Virginia Electric & Power Co** elected Donald C Barnes chairman of board of directors. Other new officers named by the board are P R Williams, treasurer, and

# The Man in the Field KNOWS when Pre-Fabricated Piping is Right

Men in the field who erect piping know when shop fabrication is well done . . . they know if the sub-assemblies fit correctly, line up easily and have all field welds or flanged joints in accessible positions. When this is the case, the erecting job is easier . . . saves both time and money.

Midwest has a Construction Department which has erected piping of all kinds for 46 years. The critical attitude of this department is the best stimulant to our four pipe-fabricating plants. The Construction Department also frequently contributes useful and practical suggestions for improving pipe fabrication.

This situation has a powerful effect in keeping the whole organization alert . . . and in encouraging continuous improvement. It is one of many reasons why you get the best when you buy Midwest Pre-Fabricated Piping . . . either as materials furnished or piping completely installed.

MIDWEST

CONTRACTING DEPARTMENT *Checks*

MIDWEST PIPING QUALITY

MIDWEST PIPING SERVICE IS NATION-WIDE

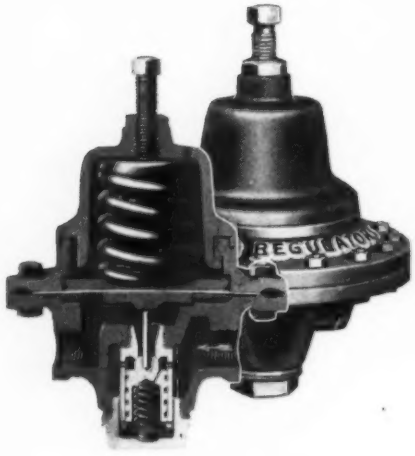
MIDWEST PIPING & SUPPLY CO., INC.

MAIN OFFICE: 1450 SOUTH SECOND ST., ST. LOUIS 4, MO.

Plants: St. Louis, Passaic, Los Angeles and South Boston • Sales Offices: New York 7—30 Church St. • Chicago 3—645 Marquette Bldg. • Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg. • Tulsa 3—533 Mayo Bldg. • Atlanta 3—Red Rock Bldg. • South Boston 27—426 First St.

2266

# A Good Pressure Regulator for Small Units



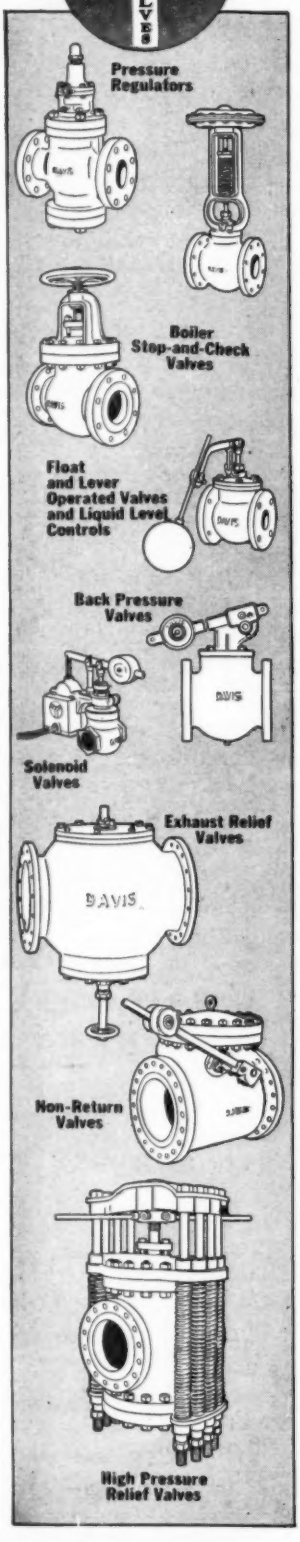
## The DAVIS No. 13 Regulator

• Where a restricted flow of steam, air, or gas at reduced pressure is desired, the Davis automatic pressure reducing valve is the ideal answer for many requirements. It is a quality pressure regulator built to give accurate, trouble-free service—yet priced low enough for use on small steam heated units such as unit heaters, presses, jacketed kettles, sterilizers, and vulcanizers as well as on all types of air-operated equipment. No. 13 features: built-in strainer, single seat, tight-closing valve, venturi type port and completely enclosed construction. All parts are accessible and renewable without disturbing pipe connections. Pressure reduction maintained regardless of circulation. Available in semi-steel, bronze, or steel body with bronze monel or nitralloy trim. Sizes ⅜" to 2". For any pressure up to 400 p.s.i. and for reduced pressures from 1 to 100 p.s.i.

### *The Davis Line of Pressure Regulators Is Complete!*

• 18 different types to choose from; standard sizes up to 24" and for pressures up to 500 p.s.i. Davis recommendations are not biased by any favored types. As the job dictates, you are free to choose between direct or pilot control . . . spring or weight loading . . . piston or diaphragm action. You have your choice of the degree of the sensitivity needed for the job—you don't have to pay for more than you need. Ask for a copy of Davis Bulletin No. 100A. For recommendations, send complete information on your job.

DAVIS VALVES




# DAVIS REGULATOR CO.

*Representatives in All Principal Cities*

2540 S. WASHTENAW AVE., CHICAGO 8, ILL.


H A Hitch, secretary. Williams succeeded George B Williams, who retired, and Hitch succeeded Richard N Benjamin. Ralph Kilday and Linwood G Parrish were made assistant secretaries and Joseph V Mitchell was appointed assistant treasurer.

Merger of Tidewater Electric Service Co into **Virginia East Coast Utilities, Inc,** has been announced. J G McClellan is president.

**Ladish Co** named H L Pehrson manager of West Coast sales of Ladish forged and seamless welding pipe fittings. Offices are at 714 W Olympic Blvd, Los Angeles 15.

G Taylor Stanton has become manager of engineering of Holtzer-Cabot Div of **First Industrial Corp,** Boston, Mass.

**Farrel-Birmingham Co** has appointed D K MacLean export manager for all lines of machinery manufactured by the company's four plants. He will make his headquarters at main office at Ansonia, Conn., and will also continue his duties as manager of sugar mill machinery sales dept.

Robert P Tyler was elected vice-president in charge of sales for **Macwhyte Co.**

Industrial Instrument Service Co announces incorporation of its business under name of **Industrol Corp.** Company has expanded its facilities to include engineering and fabrication of process control systems and assembly of completely wired and piped instrument panels.

**John A Roebling's Sons Co** has named A R Robinson manager of Seattle branch. J F Berger has been promoted to assistant sales manager, woven wire fabrics div.

Dave S Ferree has been appointed district manager of new Philadelphia sales office of **Falk Corp.** Offices are at 505 Race St. His territory includes Pa. and Del. areas, formerly handled by Martell & Ferree, and the York, Pa., area that was managed by the late John Ericson.

Philip Sporn, executive vice-president of **American Gas & Electric Co** and chief engineer of all of its subsidiaries, has been elected president of the holding company to succeed George N. Tidd, who becomes chairman of board. C E Groesbeck, former chairman, whose term of office had expired, declined reelection.

Beal W Wooden has been transferred to Norfolk, Neb., as general utility man of **Consumers Public Power District.** M V Goldsberry took Wooden's place as district manager at Fullerton, Neb. Stanley Peak took Goldsberry's place at Tekamah.

**Florida Power Corp** has elected K E Fenderson and J Shirley Gracy vice-presidents.

Nine members of **American Society for Metals** have been appointed to comprise the ASM nominating committee for 1947: (1) Chairman A H d'Arcambal, vice-president, Pratt & Whitney, W Hartford, Conn., represents Hartford Chapter. (2) C K

# COST CUTTERS

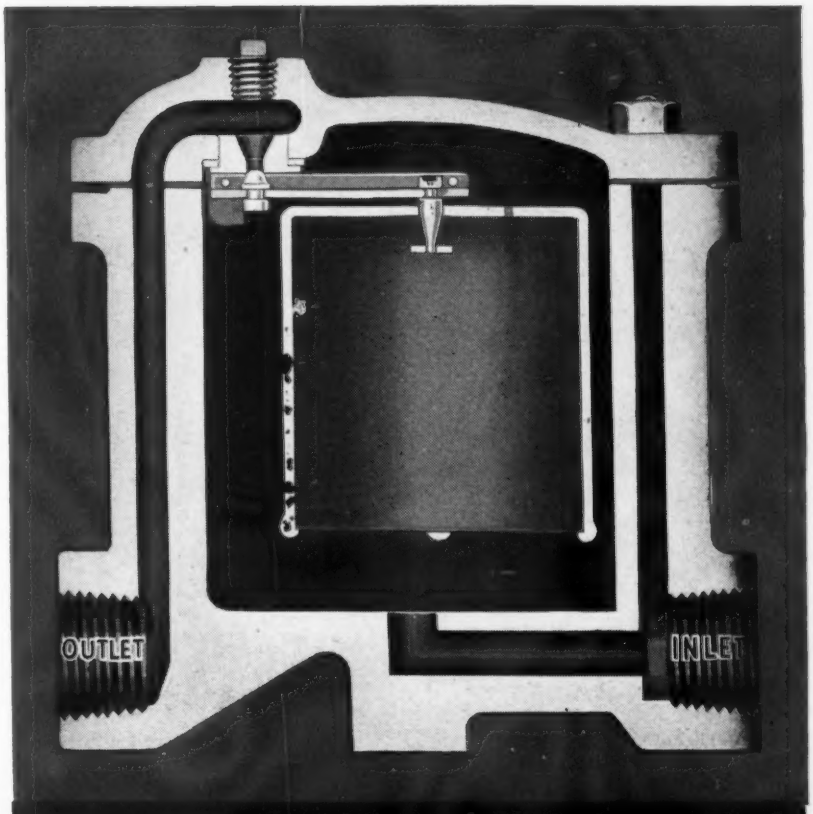
**POWER PLANTS . . .** cut costs with CLARK STEAM TRAPS. Large volume air removal gives quicker heating up action—saves fuel. Elimination of condensate permits rapid, full flow of new dry, live steam—extends life of equipment.

## For 38 YEARS...

fluid controls made by Clark have been saving fuel and increasing equipment efficiency wherever steam, air or gas are used.

*Cost Cutters in...*

- **Laundry and Dry Cleaning Establishments**
- **Petroleum Refineries**
- **Food Processing and Canning Plants**
- **Meat Packing Plants**
- **Steel Plants**
- **Breweries**
- **Chemical Plants**
- **General Industry**




The popular **CLARK SERIES 70** Inverted Bucket Type Steam Trap with Clark patented Bucket Venting Device and other exclusive Clark features. For general drainage service. Available in 3 sizes: ½", ¾" and 1". For pressures up to 200 P. S. I. and temperatures up to 400° F. Write for free catalog for complete specifications and applications of the wide line of Clark Fluid Controls.

# Clark
## FLUID CONTROLS

**THE CLARK MANUFACTURING COMPANY • DEPT.A • CLEVELAND 14, OHIO**

***Makers of a wide line of fluid controls including***

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| STEAM AND FLUID TRAPS | STRAINERS | PRESSURE REGULATORS |
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# DARTS
## CLOSE EASILY
### WITHOUT JAMMED-JOINT DAMAGE

**Because their two bronze seats are ground to a true ball joint**

Since the two non-corroding bronze seats are precision-ground to form true bearing surfaces, Darts close easily . . . without excessive wrench pressure . . . without jammed-joint damage . . . to a drop-tight connection. When needed in another location, they uncouple easily and may be used economically again and again. Body and nut are made of high-test, air-refined malleable iron and are practically indestructible.

*Your supplier will be glad to give you the whole story on Dart's unique construction.*

**E. M. DART MFG. CO.**
**Providence 5, Rhode Island**

**DART**
**UNIONS**


Lockwood, Shawinigan Chemicals, Ltd, Montreal, Que., Can., represents Montreal Chapter. (3) S P Watkins, manager of development engineering dept, Rustless Iron & Steel Div, Baltimore, Md., represents Baltimore Chapter. (4) Dr R J Radebaugh, University of Rochester, Rochester, N. Y., represents Rochester Chapter. (5) Arthur Winston, assistant to director, magnesium div, Dow Chemical Co, Midland, Mich., represents Saginaw Valley Chapter. (6) Thomas G Harvey, Monarch Steel Co, Indianapolis, Ind., represents Indianapolis Chapter. (7) Dr R L Dowdell, School of Mines & Metallurgy, University of Minnesota, Minneapolis, Minn., represents Northwest Chapter. (8) W E Burndrett, chief inspector, Hughes Tool Co, Houston, Tex., represents Texas Chapter. (9) Floyd Anderson, Gardner-Denver Co, Denver, Colo., represents Rocky Mountain Chapter.

## OBITUARIES

**Paul T Payne,** 67, district manager, Dearborn Chemical Co, Indianapolis, Ind., died Apr 7 at Witham Hospital, Lebanon, Ind.

**Lorne Argyle Campbell,** 76, member of Engineering Institute of Canada, president and general manager of West Kootenay Power & Light Co Ltd., and former British Columbia cabinet minister, died recently at his home in Rossland, B. C., Can.

**Clarence J Kim,** 55, assistant sales manager, National Electric Products Corp, Pittsburgh, Pa., died on May 15.

**William B Struebel,** 72, a retired stationary engineer, died recently in Buffalo. He was stationary engineer for Hanna Furnace Corp, Buffalo, when he retired in 1945.

**William J Jordan,** 62, an engineer at Carney Hospital, S. Boston, Mass., for many years, died there on May 17.

**Frank H Winkley,** retired manager of lighting and cable div, General Electric Co, and prominent in outdoor lighting field for over 31 years, died on April 30 at Lake Worth, Fla.

**Charles A Simpson,** 50, vice-president and sales manager of Boston Filter Co, died on Apr 26 at Quincy, Mass.

**Charles Lee,** 74, stationary engineer, died recently in his home in Utica, N. Y. He was associated with Utica Steam and Mohawk Valley Cotton Mill and Mutual Box Board Co, retiring about six months ago.

**George E Bockes,** vice-president, Korsmeyer Co, Lincoln, Neb., died May 6 at that city. He had been active with the company for the past 30 years.

**John Dix,** 68, a stationary engineer at Lang's Brewery in Buffalo for 22 years, died recently in his Buffalo home.

---

**Babcock & Wilcox Tube Co,** 85 Liberty St, New York 6, N. Y., has available a revised version of its linear table that converts inches and fractions of inches to decimal parts of a foot. The table, known as *Technical Data Card No. 110A,* should effect savings of time for those who deal with products, such as tubing, generally sold and quoted on a per-100-ft basis.

# When you "go gunning" for high costs...

## set your sights on FRICTION!

## Let a GULF LUBRICATION ENGINEER help you find opportunities for dollar savings in your plant

EVERY year friction puts its hand in U. S. industry's pocket to the tune of two billion dollars—for repairs, lost production time, and reduced plant efficiency.

To reduce the "take" of friction in your plant, make sure that each moving part in every producing unit is scientifically lubricated.

Here a Gulf Lubrication Engineer can give you valuable assistance. He will accurately determine your specific lubrication requirements, then cooperate with your operating and maintenance personnel to install the most efficient lubrication practice. Result: less wear, fewer production lags, improved equipment performance and lower maintenance costs.

The helpful counsel of a Gulf Lubrication Engineer—and the complete Gulf line of more than 400 quality lubricants — are available to you through 1200 warehouses located in 30 states from Maine to New Mexico. Write, wire, or phone your nearest Gulf office today.

**Gulf Oil Corporation • Gulf Refining Company**

*Division Sales Offices:*

**Boston • New York • Philadelphia • Pittsburgh • Atlanta**
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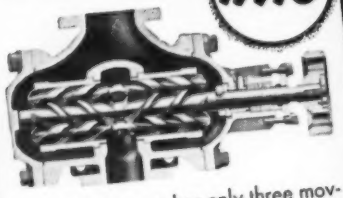
GULF INDUSTRIAL LUBRICATION

THE PUMP WITHOUT PISTONS, VALVES, BEARINGS, GEARS OR VANES

IMO



The IMO pump has only three moving parts—a power rotor and two sealing rotors – nothing to get out of order or to require adjustment. The IMO pump can be depended upon in hydraulic service, governor service, lubrication service and other applications in which continuity of operation and freedom from maintenance are vital.

For further information send for catalog 1-131-P.

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TRENTON 2, NEW JERSEY

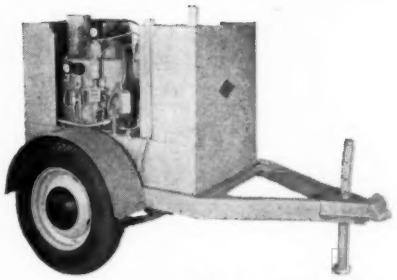
TO HELP YOU WITH FUTURE POWER PLANNING

Special section on

"MATERIALS FOR HIGH-TEMPERATURE SERVICE"

OCTOBER—POWER

16 pages summarizing the latest developments in this field.



...steam "on-tap"

for a multitude of maintenance jobs in the field

This new Oakite-Vapor Steam Cleaner meets the crying need for a portable steam generator to handle heavy-duty maintenance cleaning "out-in-the-field."

Among the many impressive features offered by the Oakite-Vapor Steam Cleaner are:

- Generation of 100 p.s.i. wet steam in one minute.
- High p.s.i. reserve for dry-steam delivery.
- 8-hour vibrationless, one- or two-gun cleaning without refueling.
- Coil clogging by cleaning solution eliminated by unique heater coil by-pass feeding of solution to steam gun nozzle.
- Scientific weight distribution and rugged chassis construction for speedy, safe over-the-highway transportation.

**Expedite These Jobs**

STRIP PAINT FROM TRANSFORMERS: Put the Oakite-Vapor Cleaning Unit to work stripping paint from transformers. Powerful Oakite steam detergent action is effective against any type finish.

AUTOMOTIVE OVERHAUL: Expedite service shop jobs with the Oakite-Vapor Cleaning Unit. Use it for degreasing chassis, transmissions, axles, engine blocks, etc.

For complete technical data contact the Oakite Technical Service Representative in your territory. Or write direct for bulletin. No obligation.

OAKITE PRODUCTS, INC.
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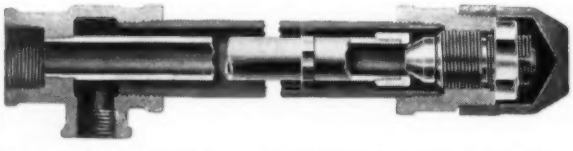
*Technical Representatives in Principal Cities of U. S. & Canada*

OAKITE

*Specialized Industrial Cleaning*
MATERIALS • METHODS • SERVICE

QUIET PLANT NOISE
with Nicholson Expansion Traps

*Quiet operation is a feature of these "Continuous Discharge" Steam Traps*



Elimination of violent-acting traps is a No. 1 measure in anti-noise campaigns. Due to their "continuous discharge" action, Nicholson expansion steam traps are extremely quiet. And they are entirely automatic; no air binding; no freeze-ups; discharge air as efficiently as water.

GIVE FULL CONTROL OF CONDENSATE'S TEMPERATURE

Their continuous discharge also makes these traps especially desirable where condensate is to be metered or passed at a certain temperature. Any pressure from 0 to 250 lbs. without change of valve or seat. In lengths from 18" to 40".

*Send for Catalog 444 or See Sweet's*

W. H. NICHOLSON & CO. 125 OREGON ST. WILKES-BARRE, PA.

# WHATEVER YOUR PIPING NEEDS

# SHAW

## FILLS THEM QUICKLY—DEPENDABLY

KNOWN SINCE 1893 FOR HIGH-QUALITY

## dependable PIPING

## prefabrication and installation

Benjamin F. Shaw Company is qualified to pre-fabricate and erect piping—any place in the United States and Canada.

President

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QUIK-LABELS
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Removable Self-Starter Strip exposes ends of Labels for you to peel!
DON'T PICK. USE SELF-STARTER STRIP TO PEEL LABELS.
FREE SAMPLES
DON'T PICK. USE SELF-STARTER STRIP TO PEEL LABELS.
1 PEEL
2 APPLY
3 IDENTIFY
LIKEWISE ON FLAT SURFACES
*Patents Pending

## QUIK-LABELS

### Mark Your Wires Faster

QUIK-LABELS code Wires, Leads, Circuits, Relays, Parts, etc., faster and cheaper. ● Pre-cut to exact size, QUIK-LABELS come on handy cards. ● Ready to use, they stik-quik without moistening, replace slow and costly string tags, roll tapes, decals, stencils, metal tabs, etc. ● Silicone plastic coated to resist dirt, grease, abrasion. ● *Self Starter Strip automatically exposes ends of Labels for you to grasp instantly—no more finger-picking.

Write for Folder and FREE Sample Cards

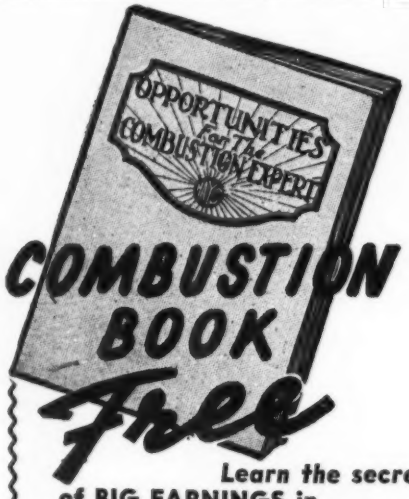
**W. H. BRADY COMPANY**

Established 1914

*Manufacturers of Self-Sticking Tape Products*

242 W. Wells Street, Milwaukee 3, Wisconsin

Factory—Chippewa Falls, Wisconsin

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There are plenty of good pay jobs in the power field today. Increase your earnings now—be a Hays-Trained Combustion Engineer. Just a little of your spare time required for the simple, easy-reading Hays Home Study Course. Hundreds of others have made better jobs for themselves through Hays training. So can YOU.

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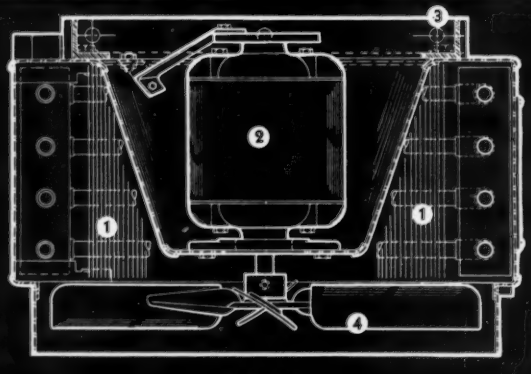
### For the tremendous demand for DUNHAM UNIT HEATERS

- RUGGED CONSTRUCTION
- COMPACT; FLEXIBLE
- FLOOR, WALL OR CEILING TYPE
- EFFICIENT—NOT EXPENSIVE




TYPE C

1 HEATING ELEMENT — non-ferrous—designed for balanced steam travel in all tubes—tested hydrostatically at 400 lb psi—suitable for working pressures up to 150 lb psi—designed to provide correct discharged air temperatures at low or high working pressure.

2 MOTOR—ball bearing, grease packed — trouble free — resiliently mounted to isolate vibration and noise.

3 CASING—streamlined in the modern manner—heavy steel with rounded corners—rigidly welded for freedom from vibration and drumming noise.

4 FAN — slow speed (1140 rpm maximum) for quiet operation — draws air through heating element and forces it down to working areas for uniform efficient temperatures. A diffuser fitting makes proper distribution.

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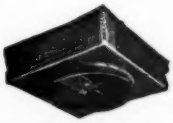
INDUSTRIAL UNIT HEATER ASSOCIATION
HEAT WITH UNIT HEATERS
MEMBER

Combines the latest modern design with characteristic Dunham precision engineering . . that's why Dunham Unit Heaters provide year-in, year-out trouble-free operation. These improved Unit Heaters meet the requirements of all industrial and commercial applications, supply fresh or recirculated air, heated and distributed evenly throughout the area. Adjustable dampers on Type 'R' regulate air volume easily and accurately. Adjustable louvres on Type 'V' discharge air at varying angles in accordance with room needs. Dunham Unit Heaters provide uniform heat distribution and equalize temperature differences between floor and ceiling. Write for new, comprehensive bulletin; C. A. DUNHAM CO., 450 E. Ohio St., Chicago 11, Ill.

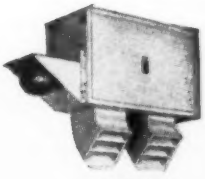
P547⅔B

FLOOR TYPE R

TYPE V



"DOWNFLO" TYPE C

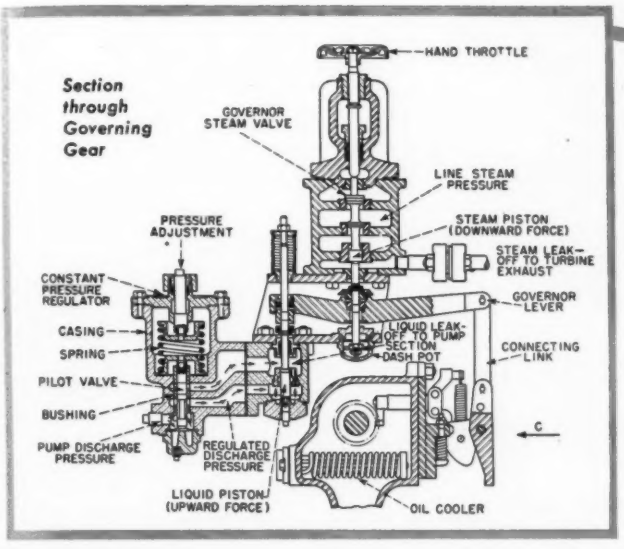


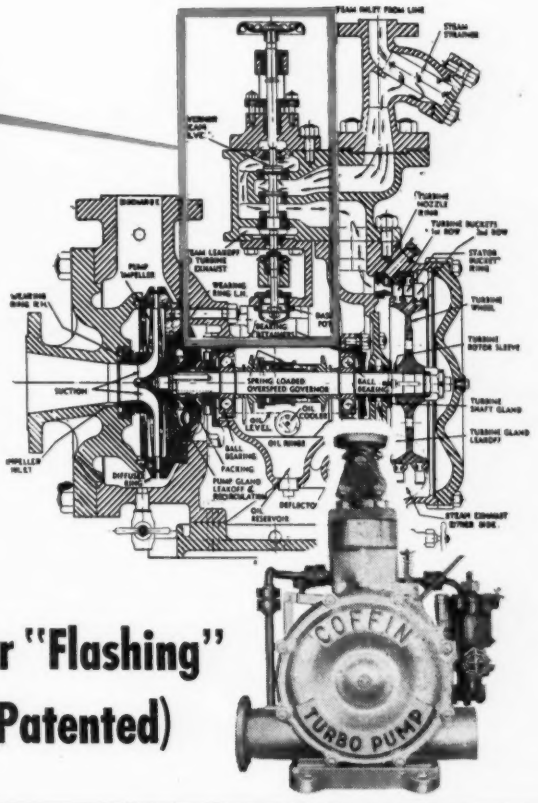
INVERTED WALL TYPE R

**DUNHAM** *HEATING MEANS BETTER HEATING*

# COFFIN TURBO PUMPS

## HIGH SPEED • SINGLE STAGE




## 5 No Damage from Loss of Suction or "Flashing" with the Coffin Governing Gear (Patented)

Loss of suction empties the pump impeller, and discharge pressure drops. *Upward* liquid force diminishes and *downward* steam force throttles Governor Steam Valve, reducing rotor speed. With recovery of suction impeller fills, discharge pressure rises, and *upward* force opens Governor Steam Valve, restoring speed and output.

*Standardized Boiler Feed Units for:*

Steam Pressures to 650 PSI
Steam Temperatures to 850 F
Back Pressures to 60 PSI

Pump Capacities to 500 GPM
Discharge Pressures to 750 PSI (Heads to 1800 feet)
Liquid Temperatures to 300 F

### UNIQUE FEATURES

1. Standardized Steam Turbine Centrifugal Pump and Governor Sets, individually engineered, assembled, and tested . . . for IMMEDIATE SHIPMENT.
2. No destructive casing erosion-corrosion.
3. No interstage leakage.
4. Wide range exact pressure governing.
5. Loss of suction reduces speed without tripping; automatic speed recovery with suction restoration.
6. High efficiency pump plus high speed two-bucket row turbine result in minimum steam consumption.
7. Matched Pump, Turbine and Governors under one responsibility.
8. Exact hydraulic and mechanical balance—light weight rotor—large bearings; result: bearing troubles practically unknown.
9. Pump Gland Leakoff provides adequate recirculation; suction pressure only on packing.
10. Rigid one-piece steel casing plus heavy shaft plus ample clearances result in no damage from dry operation.
11. All parts made to gage and replaceable without fitting; all parts in stock at factory with wearing parts available from agencies' stocks.
12. Proved for performance over a period of more than twenty years in service.
13. Compact, light in weight, quiet and low in maintenance.

Literature sent on request; specific proposals on receipt of operating data.

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## Make Your Overhead Valves SAFE and Easy to Reach---

With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

**BABBITT STEAM SPECIALTY CO.**
New Bedford, Mass.

## "GUNITE" Concrete

(since 1915)

*Linings for*

STEEL BUNKERS •
DUCTS, HOPPERS •
STACKS •
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STEEL & PIPE
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## NOW! A better solution for BOILER BLOW-DOWN DISPOSAL PROBLEMS

## THE WILSON CENTRIFUGAL MUFFLER AND BLOW-DOWN SEPARATOR

YOU can't blow down your boilers directly to the sewer, but you no longer need to build and maintain an expensive blow-down tank, either! The Wilson Centrifugal Muffler and Blow-Down Separator performs all of the required functions quietly . . . efficiently . . . economically.

• SCIENTIFIC DESIGN. A patented development by widely experienced engineers. Blow-down is jetted tangentially into muffler-separator. A vortex is created which allows flash steam to pass off quietly through vertical vent to atmosphere. With pressure and flash dissipated, blow-down water is then free to flow to sewer by gravity.

• APPROVED BY USERS. Already widely used for boilers located in municipal areas. Eliminates objections to using sewers for blow-down disposal.

• EASY TO INSTALL. See diagrams at right. Only simple piping connections needed. No expensive tanks, supports, or alterations.

• ECONOMICAL. List price, $80.00. No maintenance, supervision, or operating costs. Ask for complete information. Available for prompt delivery.

### TYPES OF INSTALLATIONS

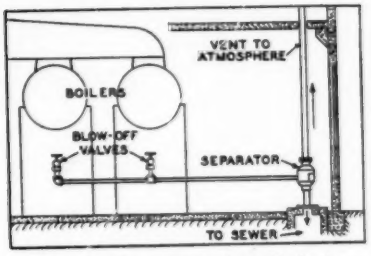



*Fig. 1*—Separator installed in boiler room over sump and vented to atmosphere. In asking for recommendations, give full data on contemplated installation, including boiler steam pressure.

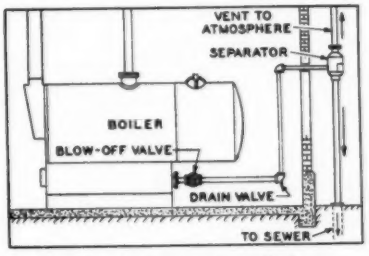



*Fig. 2*—Separator installed outside boiler room wall.

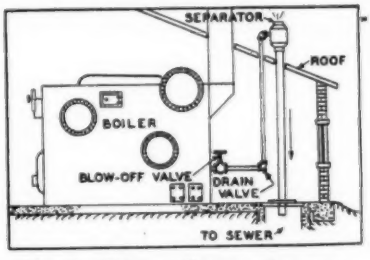



*Fig. 3*—Where distance is not more than 15' above boiler water level, separator may be located on roof.

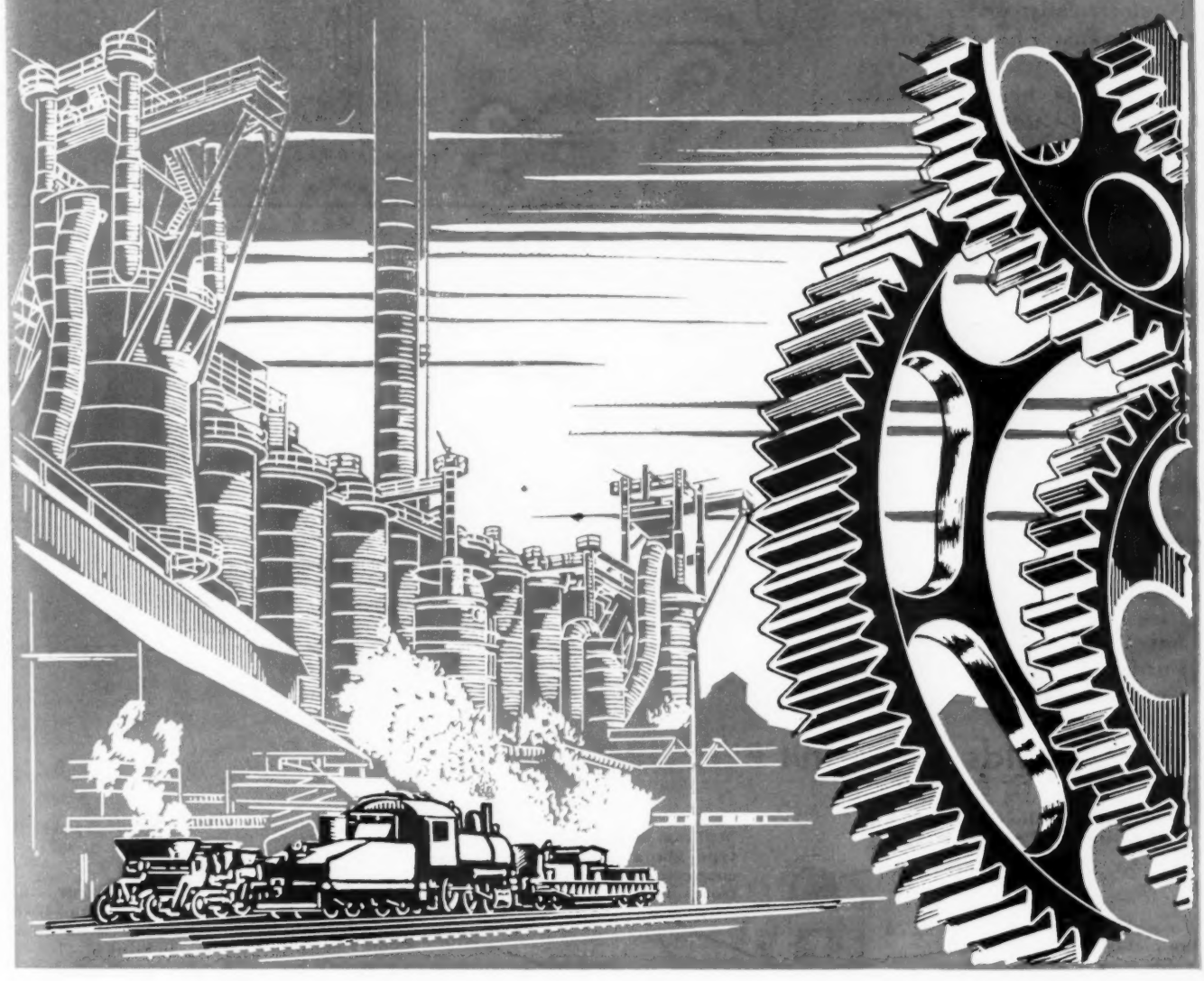
## WILSON ENGINEERING CORPORATION

122 So. Michigan Avenue
Chicago 3, Illinois

**OPPORTUNITIES FOR REPRESENTATIVES**

*MANUFACTURERS' AGENTS* selling steam traps, valves, return systems and other boiler room equipment, will be interested in this new product. Ask for information IMMEDIATELY.

# TYCOL ENGINEERED LUBRICATION



## cuts "down time" . . . increases production

TYCOL
INDUSTRIAL LUBRICANTS

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**Chicago • Detroit**
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TIDE WATER ASSOCIATED OIL COMPANY
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Under all conditions the proved performance of Tycol lubricants more than meets their recommended service.

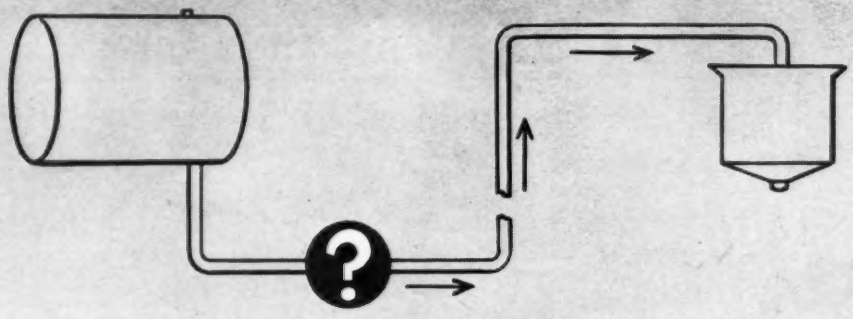
Rigidly controlled and tested during manufacture, Tycol oils and greases retain their uniformity within each classification — from the first drain to the last. This unvarying high quality accounts for Tycol's wide acceptance among operators interested in cutting down time . . . top efficiency . . . increased production.

Whatever your lubrication need, there's a Tycol oil or grease *scientifically engineered* to afford greater economy . . . longer machine life for every piece, and type of equipment. Let Tide Water Associated help you select the best lubricant for your particular need. Write your nearest Tide Water Associated Office for full details.

**LUBRICATION—"ENGINEERED TO FIT THE JOB"**

# PROBLEM:

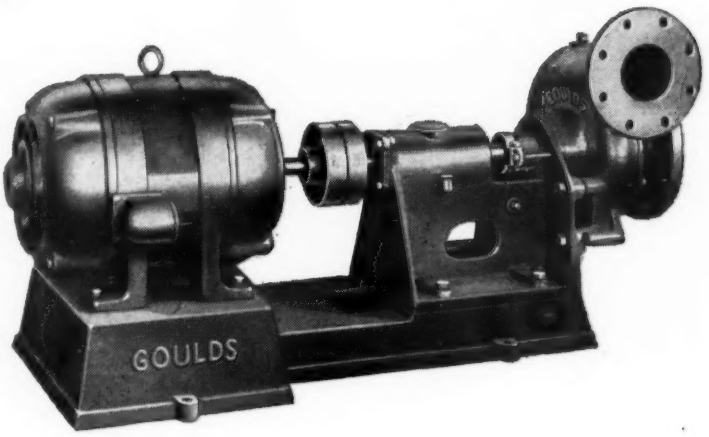
A brewery requires an electrically driven pump to transfer hot wort at 120 G.P.M. under a total dynamic head of 55 ft. Which Goulds Pump is *the* pump for *the* job?



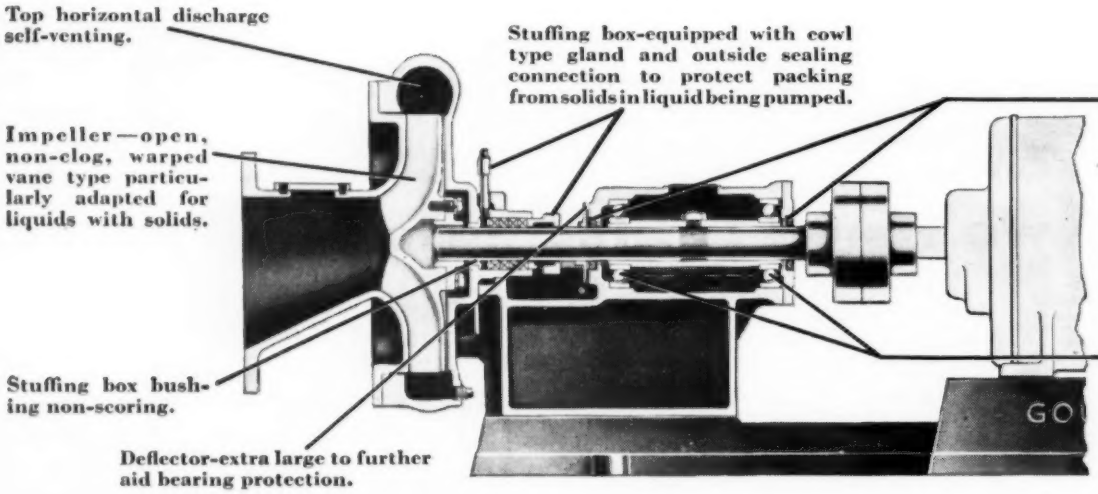

# SOLUTION: GOULDS 3"

## FLEXI-UNIT PUMP WITH 3 H.P. 1750 R.P.M. MOTOR

To avoid contamination, the Flexi-Unit pump is made so that the wort comes in contact with bronze parts only. The Flexi-Unit is designed and constructed for trouble-free, day in day out service on a wide variety of jobs. It performs well, handling thick, viscous, corrosive liquors or pumping water for general water supply. A Jack-of-all-trades that solves many pumping problems, Flexi-Unit is made in ten sizes and types with capacities from 20 to 4000 G.P.M. When you have a pumping problem, call or write Pump Headquarters or your nearest Goulds office.




## Why Goulds Flexi-Unit PERFORMS SO WELL


Top horizontal discharge self-venting.
Stuffing box-equipped with cowl type gland and outside sealing connection to protect packing from solids in liquid being pumped.
Klosures provide dust and moisture-proof enclosure of bearings.
Impeller—open, non-clog, warped vane type particularly adapted for liquids with solids.
Stuffing box bushing non-scoring.
Double ball bearing construction carries both radial and unbalanced thrust loads. Oil lubrication with gauge.
Deflector-extra large to further aid bearing protection.

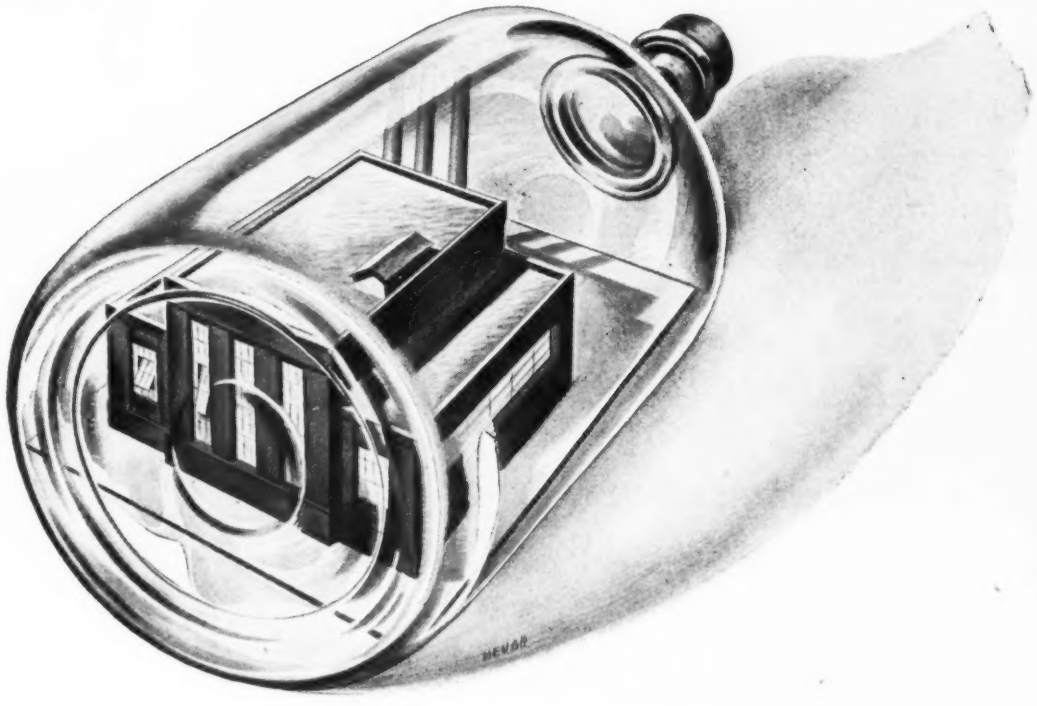
# GOULDS

GOULDS PUMPS, INC. • SENECA FALLS, N.Y.

PUMPS, INC.

*the* PUMP FOR *the* JOB

# IT'S ALL IN HOW *You look* AT IT!



This looks like a model boiler plant in a bottle . . . *but it isn't!*

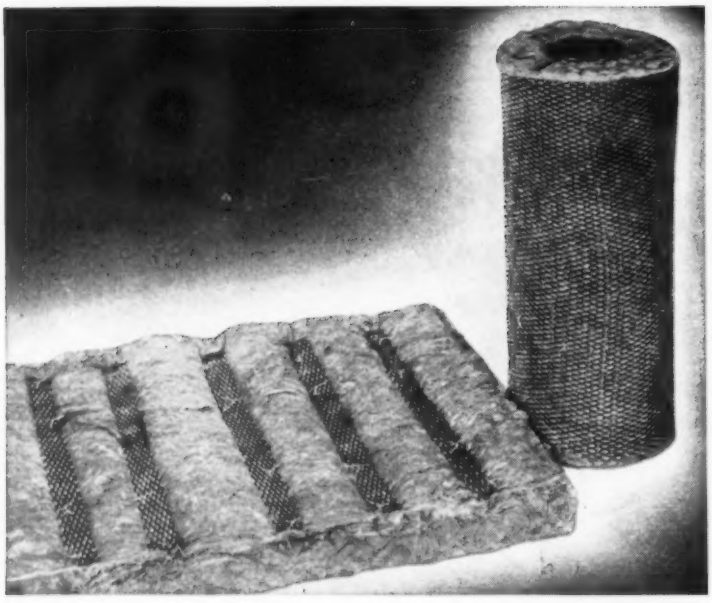
**Actually it's a symbol . . . a symbol of a *production bottleneck*. Boiler plants can be just that when plagued with *excessive* blowdown, scaling and corrosion.**

**Efficient boiler plant operation is possible, but it takes a lot more than wishful thinking to make it so. Playing no small part in trouble-free operation is the installation and application of a complete, *individualized* water conditioning service that includes initial investigation, plant control, a daily testing program, periodic check-ups, analyses of water samples and regular engineering reports on plant operation. Such a service is rendered by the Betz organization. Write for details on what Betz engineers might do for you . . .**

**W. H. & L. D. BETZ, Gillingham and Worth Sts., Philadelphia 24, Pa.**
**In Canada: Betz Laboratories Limited, Montreal 1.**

# BETZ

**BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT**



*More power*
*to you with*
**EAGLE-PICHER**
*Insulations*

# Eagle-Picher "77" Pipe Covering

***is permanently efficient to 1200 F!***

Because it remains efficient, even at the high temperature of 1200 F, Eagle-Picher "77" Pipe Covering is widely preferred by industry for permanent protection against heat loss through pipes. It consists of chemically and physically stable Eagle-Picher Insulating Wool felted and secured between metal fabrics. Does an outstanding job on steam piping and other types of hot lines. Can be cut on the job with ordinary metal shears. Water and steam repellent. Complete data sent on request.

***The complete line of Eagle-Picher Insulations includes:***

Eagle-Picher Super "66" Cement
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Eagle-Picher
Low Temperature Felts
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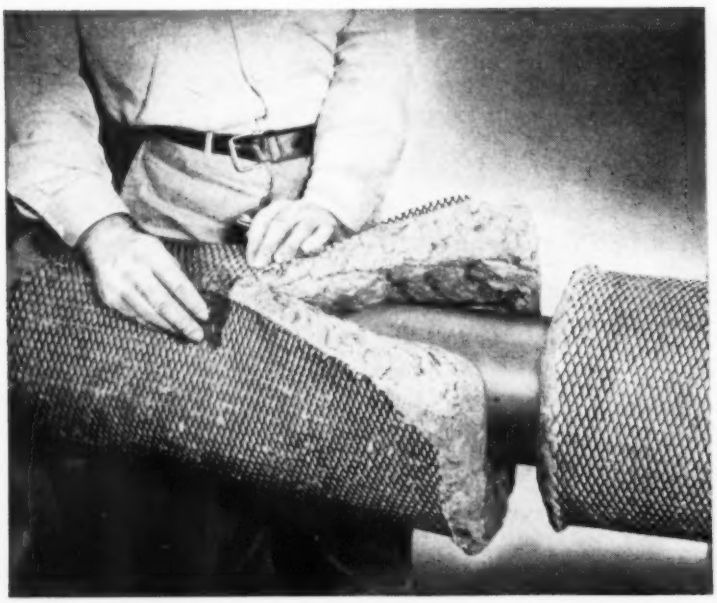
Eagle-Picher Insulseal
Eagle-Picher Insulstic
Eagle-Picher Swetchek
Eagle-Picher Finishing Cements



**EAGLE-PICHER INSULATIONS for**

EAGLE EP PICHER

*High and low temperature*

Since 1843
THE EAGLE-PICHER COMPANY
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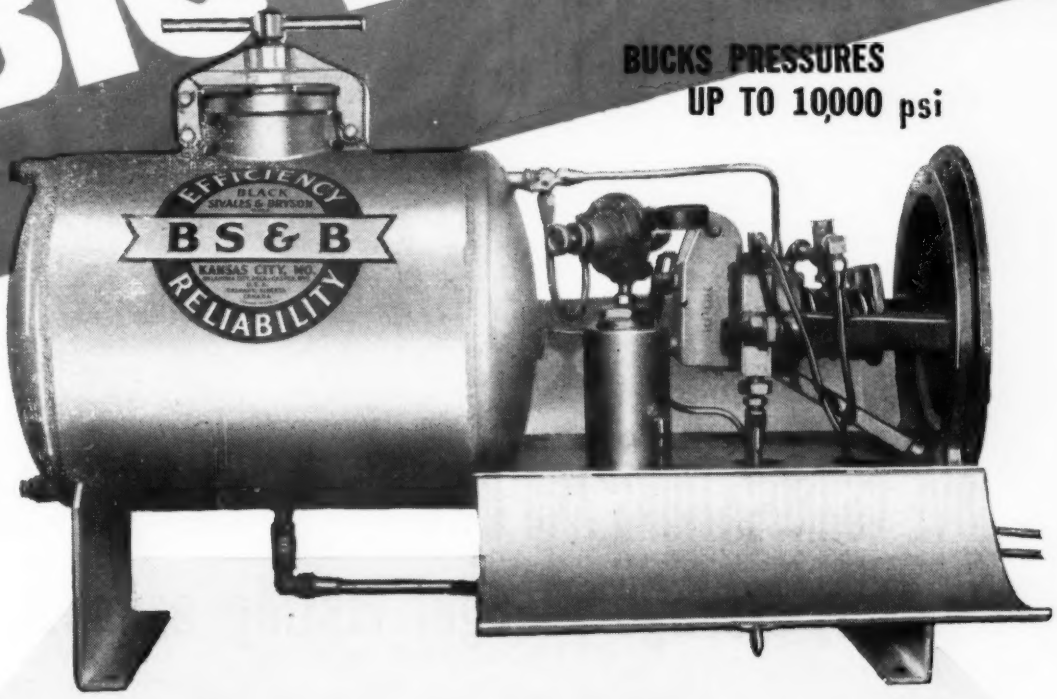
# Little Fellow with the BIG "PUSH"

**BUCKS PRESSURES UP TO 10,000 psi**




## The BS&B HORIZONTAL AUTOMATIC CHEMICAL FEEDER

Stumped by a problem of precise, timed feeding? A Black, Sivalls & Bryson Chemical Feeder accurately injects liquids into high-pressure lines, treating chemicals into flow lines, paraffin solvents into well casings, methanol into gas lines . . . handles many other similar jobs in refineries and process industries. Operates inexpensively on air or gas pressure of 20 to 50 psi. Achieves wide flexibility of discharge. Equally efficient with light or heavy viscous chemicals.

SPECIFICATIONS

*Maximum Chemical Output* per Day—12½ gallons with ⅜" piston; 50 gallons with ¾" piston
*Capacity of Chemical Tank*—10 gallons
*Piston Sizes*—⅜" and ¾"
*Overall Size*—1' 2" wide—3' 3" long—2' 1" high.

Available for immediate shipment. Your nearest BS&B Sales Engineer has complete specifications and details. Call him today . . . or write the Executive Offices, Black, Sivalls & Bryson, Inc., Power and Light Building, Kansas City 6, Missouri.

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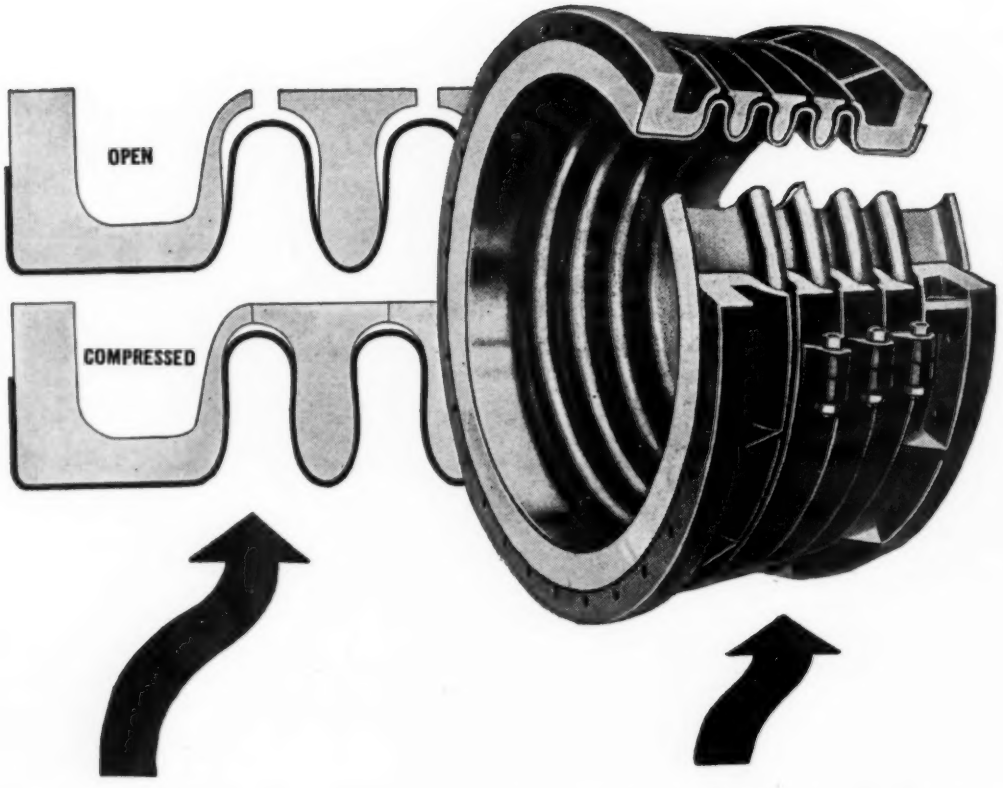



# ALL-CURVE CORRUGATIONS AND DIRECTED-FLEXING EQUALIZING RINGS mean better, stronger, longer lasting expansion joints

***E. B. Badger & Sons Company is the original and sole manufacturer of BADGER Expansion Joints***

EXCESSIVE flexing or stress at any point is virtually impossible in a Badger Expansion Joint.

The ALL-CURVE design of the corrugations and directed-flexing equalizing rings (patented) in Badger joints assures an even distribution of stresses throughout *each* corrugation and also over *all* the corrugations. There's no danger of stresses localizing in pockets or junctions—nor in any one corrugation.

When you install Badger Packless Corrugated Self-equalizing Expansion Joints in steam, gas, oil, or other lines, you have the most dependable, longest lasting expansion joints on earth!

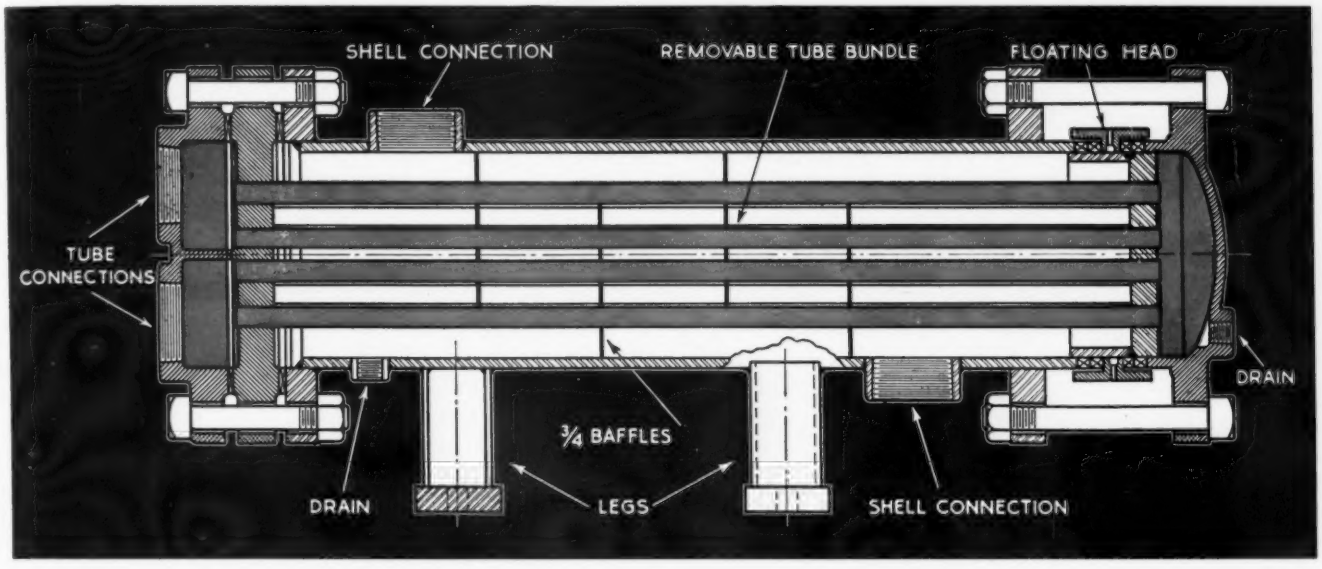
***MADE IN COPPER, STAINLESS STEEL, AND OTHER ALLOYS***—Copper for normal pressures and temperatures; Stainless Steel and other alloys for higher requirements—and where corrosion is a problem. Single or multiple corrugations—for traverses from a fraction of an inch upward. Also made in Non-equalizing type (without rings) for uses that do not require added protection. Send for Bulletin No. 100 (Self-equalizing) or Bulletin No. 200 (Non-equalizing).

**E. B. BADGER & SONS CO., 75 Pitts St., Boston 14, Mass.**
*AGENTS IN PRINCIPAL CITIES*

# Badger

**PACKLESS CORRUGATED EXPANSION JOINTS**

# HEAT EXCHANGERS *With every Feature* THAT MEANS EFFICIENCY



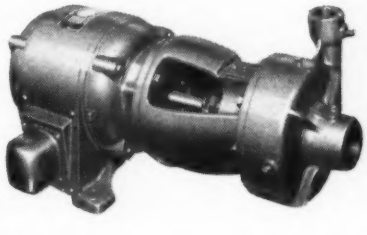

Wherever efficient, economical exchange of heat between liquids is required, B & G Heat Exchangers do a job which satisfies the most critical. These units incorporate many superior features developed by years of practical experience in heat transfer work. Sturdy and compact in design, they have semi-floating heads, removable shell bonnets and straight, easily removed, easily cleaned tubes.

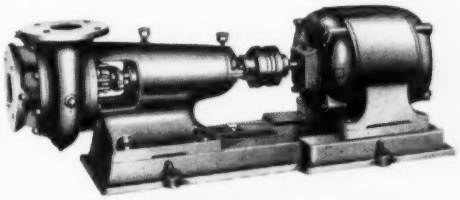
## A FEW APPLICATIONS

- Brine Heaters
- Caustic Solution Heaters
- Chemical Solution Heaters
- Condensate Coolers
- Condensate Heaters
- Cottonseed Oil Heaters
- Crude Oil Heaters
- Diesel Engine Jacket Coolers
- Feed Water Heaters
- Fuel Oil Heaters
- Gasoline Coolers
- Gasoline Heaters
- Gear Oil Coolers
- Glycerine Heaters
- Heated Rolls
- Hot Water Convertors
- Kerosene Heaters
- Laundry Water Heaters
- Light Oil Heaters
- Linseed Oil Heaters
- Lubricating Oil Coolers
- Lubricating Oil Heaters
- Mineral Oil Heaters
- Oil Heaters
- Oil Pumping Systems
- Prestone Heaters
- Process Water Heaters
- Quenching Oil Coolers
- Service Water Heaters
- Solution Heaters
- Swimming Pool Heaters
- Tar Heaters
- Turbine Oil Coolers
- Vegetable Oil Heaters
- Water Coolers
- Water Heaters

**B&G SERIES 1522 PUMP**

This is the unit which really handles tough pumping jobs. Seven big features . . . 1. Mechanical Seal, no stuffing box leakage—2. Standard Motors—3. Spring-type Flexible Coupling—4. Easy to service—5. Interchangeable parts—6. Compact Design—7. Low in Cost.





**B & G CENTRIFUGAL PUMP**

*Designed and constructed to meet the most rigorous operating conditions found in commercial applications. Enclosed or semi-open impellers—flexible coupled or motor integral with pump.*

**WRITE FOR INFORMATION**

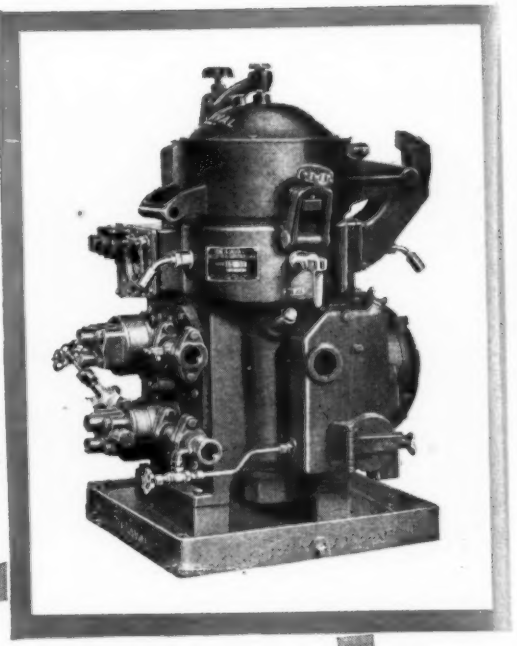
You'll find it to your advantage to get complete information on this well-known line of heat transfer and pumping equipment.

**Hydro-Flo* PRODUCTS**

**BELL & GOSSETT CO.,** Dept. AC-36, Morton Grove, Ill.

*Reg. U. S. Pat. Off.

# Purify New Turbine Oil and Prevent DETERGENT ACTION



WHEN turbine oil is changed, the new turbine oil has a detergent action. It picks up deposits of sludge and sediment that may have settled out from the old oil in the turbine reservoir and piping. The best way to prevent damage by this picked-up material is to remove it from the oil by centrifugal force before it can circulate through the system.

A De Laval Oil Purifier is the most foolproof way of keeping turbine lubricating oil clean. In the bowl, or purifying member, both the solid impurities and any moisture that may get into the oil are instantaneously separated out. Removed water is discharged continuously, and dirt is stored in the bowl, out of the zone where purification takes place.

Action of the De Laval machine is wholly mechanical—De Laval Purifiers do not remove the valuable inhibiting agents added by the refiners.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
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**DE LAVAL OIL PURIFIERS**

**FOR MORE DEPENDABLE POWER PRODUCTION**

# FOR THE FIRST TIME!

## A UTILITY Jackhamer

*Having* **UTILITY WEIGHT**
**REAL DRILLING POWER**
**AUTOMATIC ROTATION**
*Air Operated*

This amazingly *powerful* Jackhamer weighs only 14 lbs and can be used wherever *light weight* is of first importance. It handles easily on a scaffold or ladder and makes short work of holes for hangers, anchor bolts, pipe, conduit, dowels, and reinforcing rod. It is ideal for plug and feather work.

The "J-10" tears out brick work for doorways and windows or cuts anchors for girders and joists. It is used for chiseling and channeling and for vibrating concrete forms.

At last, here is a real Rock Drill—*air operated*—built for plant maintenance work. It is no longer necessary to use make-shifts. The "J-10" UTILITY Jackhamer is fast, powerful, easy to handle, has strong rotation and hole blowing and uses standard Jackbits. Buy a J-10 UTILITY Jackhamer to save TIME AND MONEY.

The "J-10" UTILITY Jackhamer is built by the world's largest manufacturer of Rock Drills and Compressors

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**Ingersoll-Rand**
11 BROADWAY, NEW YORK 4, N. Y.

# *Eight Improvements*

# make GENUINE STRONG 70 Series Traps Better than Ever!

## *Look at these new features:*

**1** Renewable seat replacing pressed-in design;

**2** Anum-Metl* valve and seat with new scientifically designed Hi-Cap* (patent applied for) orifice . . . up to 25% greater capacity;

**3** Oversize inlet and outlet ports—increased flow capacity;

**4** Relocated inlet and outlet connections—avoids backflow on light loads;

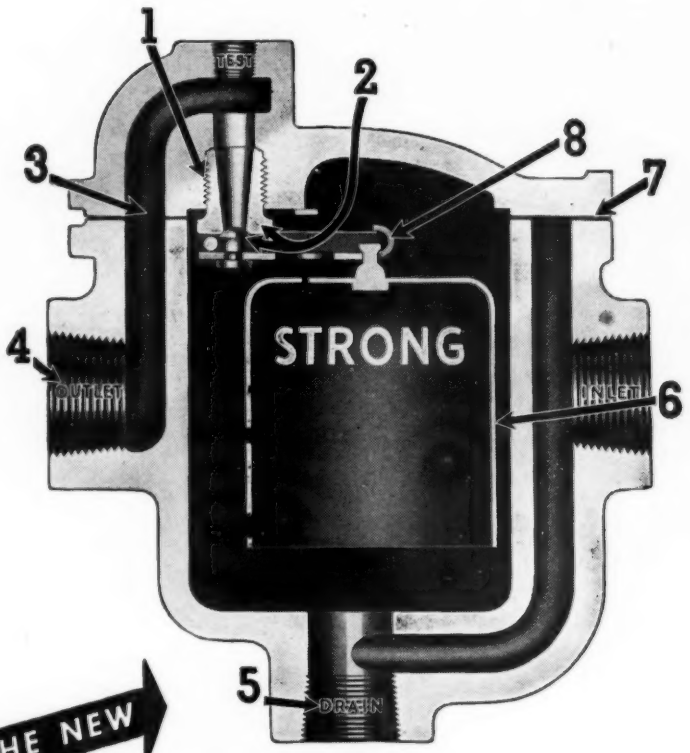
**5** Drain connection added—available for bottom inlet;

**6** One-piece, deep-drawn, stainless bucket—no welds;

**7** Larger gasket area—means positive seal;

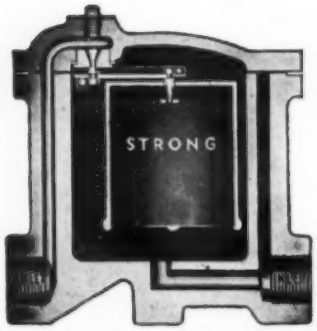
**8** New, improved, stainless, high-ratio leverage.

***Plus*** Adaptability to older models with change-over assembly including Hi-Cap orifice.




New 70 Series Strong Trap, No. 170

COMPARE THE NEW WITH THE OLD




Old 70 Series Strong Trap

In improving the 70 Series trap, Strong has remembered the thousands of older style 70 Series traps still in service after many years. Each improvement bears the "proof in service" label, so Strong quality remains uniformly high. Service continues to be available on all Strong traps, and they can be completely modernized to include the improvements listed above.

With a complete line of Strong open and inverted bucket traps at their disposal, Strong engineers can specify exactly the right type of trap for your particular application. For full details, write for the new Strong Catalog No. 67.

**STRONG, CARLISLE & HAMMOND COMPANY, Cleveland 13, Ohio**

*Registered Trade Mark

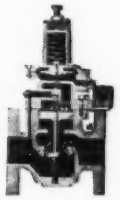
REG. TRADE MARK

## OTHER STRONG STEAM SPECIALTIES

ANUM-METL Reg. Trade Mark

Strainer

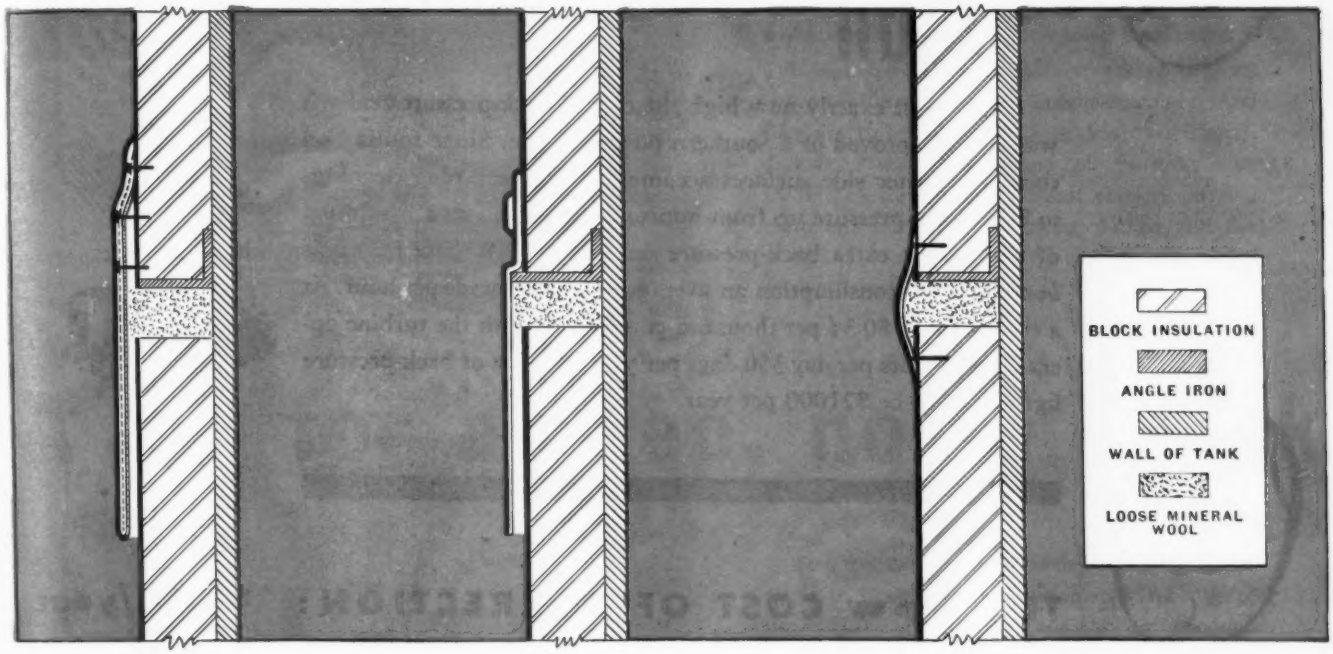
No. 80 Series Trap



Reducing Valve

# How would YOU weatherproof this expansion joint?

**Outdoor vertical tank is held at high temperatures, has expansion joint in the insulation.**




☐ Flap of weatherproof plastic, wire mesh, and roofing felt, stapled to insulation above joint?

☐ Apron or flashing of sheet metal, banded to the tank or vessel above projecting angle iron?

☐ Collar of flexible fabric saturated with weatherproof plastic, stapled to insulation above and below?

## HERE'S WHAT THE ARMSTRONG ENGINEER RECOMMENDED:

The first method is comparatively expensive because it requires slow and painstaking application. Also, if the tank stands in the sun, external heat may eventually cause the flap to stick. Movement would then tear the insulation.

The third method is lowest in cost. But it does not look very neat, and the cloth cannot be so full that it will fold, or it will crack. Therefore, this weatherproofing is desirable only where the vertical movement caused by expansion and contraction is relatively slight —and where cost is a vital factor.

The second method is recommended for most jobs. Its cost is moderate, and it provides positive assurance that the joint can open and close freely without damaging the insulation. Also, maintenance is simple and inexpensive.

* * *

True, weatherproofing an expansion joint is a detail—and a fairly uncommon one at that. That's just why we're talking about it. Your Armstrong engineer, construction foreman, and craftsmen all know the importance of such details. Every "trifle" on a heat insulation job can be costly to you if it's done wrong—and it can be mighty helpful when it's handled right.

When you work with Armstrong's Contract Service, you have the advantage of training, skill, and experience accumulated through more than 40 years. This single responsible contractor assures you of getting the right materials, the right planning and supervision, and the right workmanship on every detail of your job.

### Free Insulation Chart

This chart lists types and thicknesses of insulation for temperatures from 300° below zero to 2800° F. Write for your copy to Armstrong Cork Company, Industrial Insulation Dept., 7007 Maple Ave., Lancaster, Penna.

**ARMSTRONG'S INDUSTRIAL INSULATION**

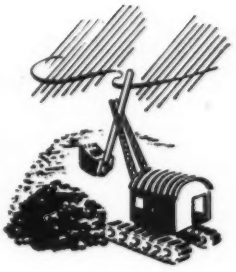
*Complete Contract Service For All Temperatures*

From 300° Below Zero

To 2800° Fahrenheit

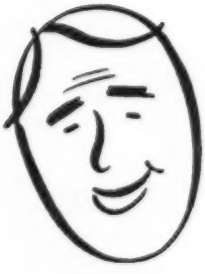
## THE HIGH COST OF BACK-PRESSURE: $21000/year

Just exactly how high the cost of back-pressure really is was recently proved in a Southern power station. Slime-fouling on condenser water side surfaces accumulated between plug cleanings to build back-pressure up from approximately 0.6″ to a maximum of 1.1″. That extra back-pressure on a 30000 KW base load unit *boosted* steam consumption an average of 7500 pounds per hour. At a cost of about $0.34 per thousand pounds and with the turbine operating 24 hours per day 350 days per year, the cost of back-pressure figures out to be $21000 per year.



## THE LOW COST OF CORRECTION: $5000/year

Chlorination applied through the W & T De-Sliming Process, at a total annual cost of approximately $5000 including amortization and all operating expenses kept the condensers slime-free, eliminated the need for plug cleaning and reduced equipment outage time.



## NET $AVINGS: $16000/year

Not only did chlorination make operations easier and more effective, but the annual savings in steam alone amounted to $16000 — enough to pay for the investment in less than two years.

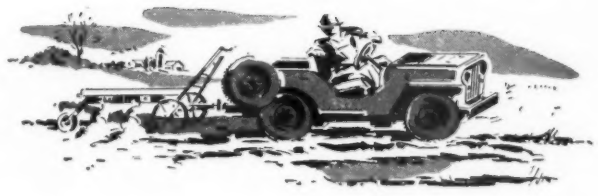
Your W&T Representative will be glad to make a study for you—without obligation, of course—to see if you, too, are paying the high cost of back-pressure.

CD-26

**WALLACE & TIERNAN PRODUCTS, INC.**

Manufacturers of Chlorine and Ammonia Control Apparatus

Belleville 9, New Jersey • Represented in Principal Cities



WHEN your equipment calls for small horsepower, you're saving money when a Coppus "Blue Ribbon" Steam Turbine is on the job.

Coppus makes turbines in six frame sizes from 150 HP down to fractional — so you can "fit" the power more closely to the need. No reason to pay extra for ordinary "elephant power" turbines, when you have a small horsepower requirement.

Many well-known manufacturers of original equipment have selected Coppus turbines. And they are to be found on U. S. destroyer escorts, driving vertical lubricating oil pumps . . . on U. S. Casablanca class aircraft carriers, driving main and auxiliary circulating pumps and fire pumps . . . on more than 90% of all Landing Ship Docks, driving condensate and clean ballast pumps.

# A job for a Jeep, not a Truck

You, too, can rely on their dependable performance to meet your requirements for "jeep" power. Like all Coppus "Blue Ribbon" products (blowers, ventilators, gas burners, etc.), the Coppus turbine is a precision-made product — its accuracy controlled by Johansson size blocks — and every turbine is dynamometer-tested before shipment. Since 1937, more than 85% of orders have been repeat orders. Write for Bulletin 135-10. COPPUS ENGINEERING CORPORATION, 167 Park Avenue, Worcester, Mass. Sales Offices in THOMAS' REGISTER. Other products in SWEET'S, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

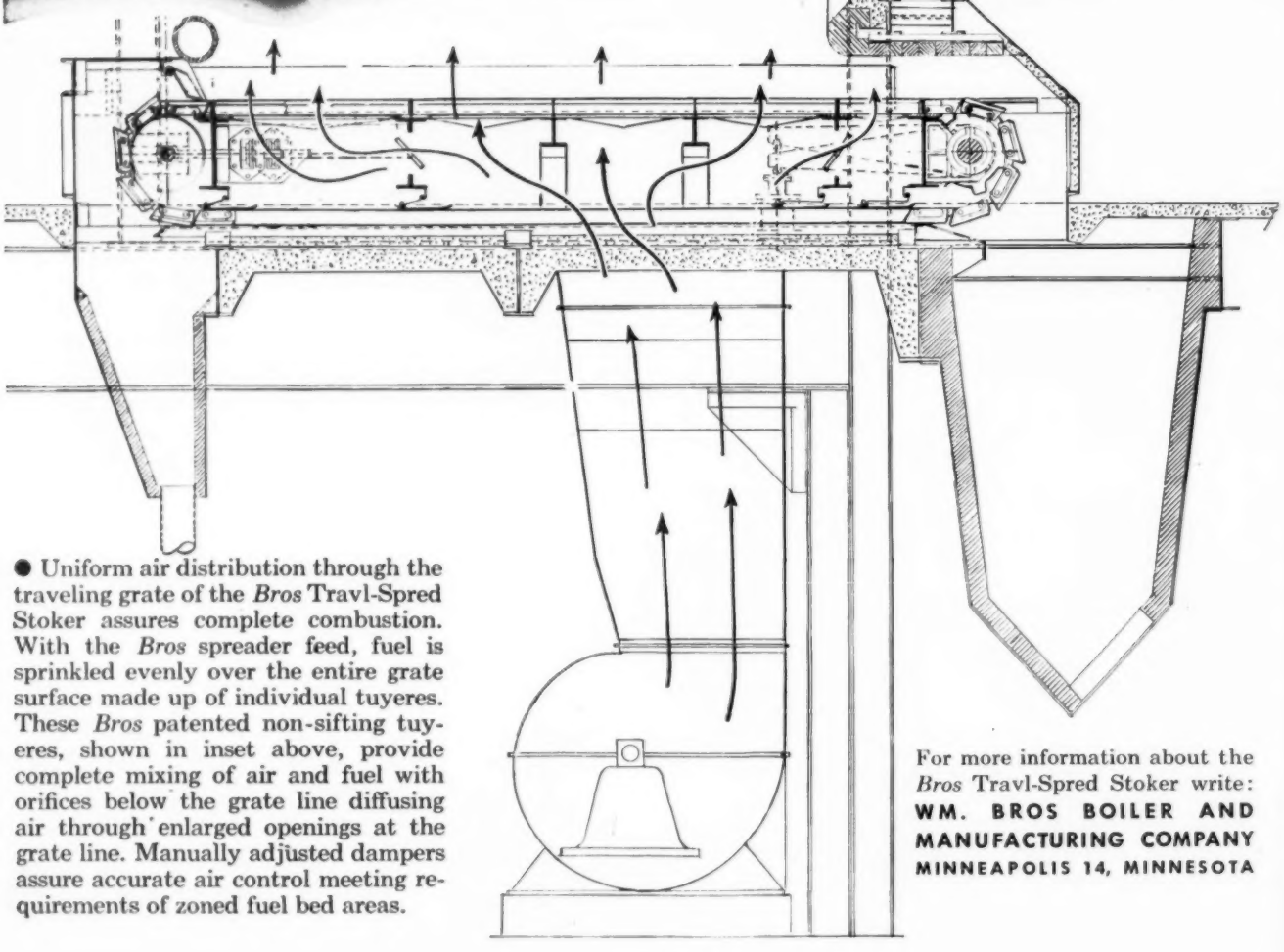
ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

# No AIR-STARVED Spots

WITH THE

# BROS

## Travl-Spred STOKER



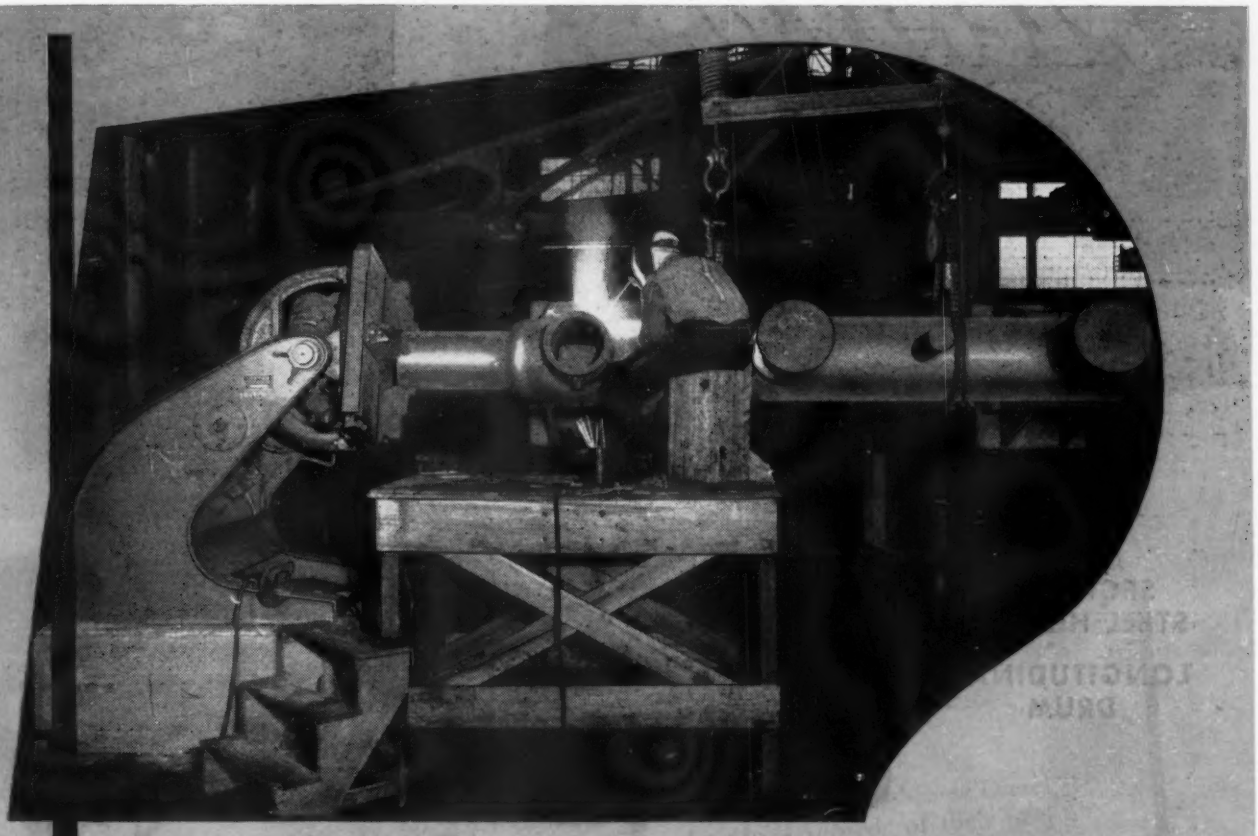
● Uniform air distribution through the traveling grate of the *Bros* Travl-Spred Stoker assures complete combustion. With the *Bros* spreader feed, fuel is sprinkled evenly over the entire grate surface made up of individual tuyeres. These *Bros* patented non-sifting tuyeres, shown in inset above, provide complete mixing of air and fuel with orifices below the grate line diffusing air through enlarged openings at the grate line. Manually adjusted dampers assure accurate air control meeting requirements of zoned fuel bed areas.

For more information about the *Bros* Travl-Spred Stoker write:
**WM. BROS BOILER AND MANUFACTURING COMPANY**
**MINNEAPOLIS 14, MINNESOTA**

# BROS

**WATER TUBE, FIRE TUBE BOILERS • OVER FEED, UNDER FEED • HYDRAULIC-TRAVL-SPRED STOKERS**

# MODERN PRESSURE PIPING REQUIRES SPECIALIZED SHOP FACILITIES AND PERSONNEL



## SPECIAL WORK ROTATING MACHINES Permit Welding Under MOST FAVORABLE CONDITIONS

Welding of pressure piping is an exacting and difficult task. The welder must be highly trained and specialized . . . and it is important that he work under the best possible conditions. While it is true that satisfactory welding can be done in other positions, the downhand position provides definite advantages in quality and uniformity of the weld . . . in speed and economy.

Hence, among the most important machines in the shop of a qualified pipe fabricator are the rotating positioners for welding. These are to be found in many types and sizes. They enable the welder to work under the most favorable conditions at all times.

Welders in these shops are specially qualified, too. They are selected for exceptional welding skill—carefully trained in pressure pipe work, and are under continuous, expert supervision and inspection. Test pieces are frequently included in the work without knowledge of the welder. Laboratory tests of these provide close check upon his work. Working as they do day after day on the same type of job, these welders acquire the highest possible skill.

This special equipment—procedure control—careful training—and close supervision assure superior welding in these shops. Such welding is another way in which qualified fabricators provide better piping.

**THE PIPE FABRICATION INSTITUTE**

P.F.I. THE PIPE FABRICATION INSTITUTE

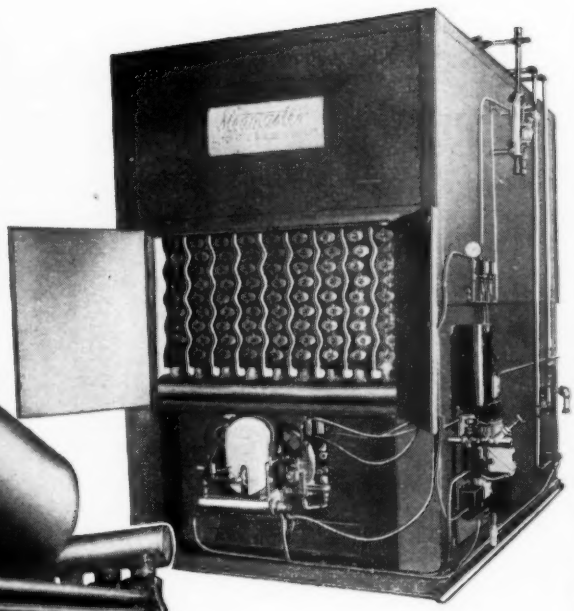
*Devoted to the Technical and Economic Problems in Piping*

1109 CLARK BUILDING PITTSBURGH, PA.

Write for Technical Bulletin describing pressure piping fabrication

3929-S

# STEAMASTER is the BOILER WITH PLENTY OF GUTS!



**WATER TUBE DESIGN**

**INCLINED TUBES**

**SECTIONAL STEEL HEADERS**

**LONGITUDINAL DRUM**

THE GUTS of the Steamaster Boiler

## *Steam is water plus heat*

It is **how** that heat and water are utilized that makes a boiler good or bad. Now take a look at the guts of the Steamaster Boiler — the famed water tube principle, combined with sectional steel headers and inclined tubes gives you a superior design resulting in high thermal efficiency and economical maintenance . . . at no greater cost than an average so-called "packaged" boiler.

**Yes...** Steamaster Boilers have the guts that enable them to be fired over their rated capacity with no loss in efficiency — the guts to keep on economically filling your steam requirements year after year.

POWER ENGINEERS AGREE . . .

STEAMASTER IS THE BOILER WITH PLENTY OF GUTS!

Steamaster

**AUTOMATIC BOILER CO.**

Compton at Slauson Ave., Los Angeles 11

SALES AND SERVICE IN ALL PRINCIPAL CITIES

**The advantages of a WATER TUBE BOILER designed the Steamaster Way**

**EASY INSPECTION AND MAINTENANCE** Every tube immediately accessible. Just open the heavily insulated access doors.

**LARGE COMBUSTION AREA . . . THREE PASS HEAT BAFFLING . . .** Gives high thermal efficiency — economical consumption of fuel.

**POSITIVE TIDAL CIRCULATION OF WATER** Maintains all parts at equal temperature.

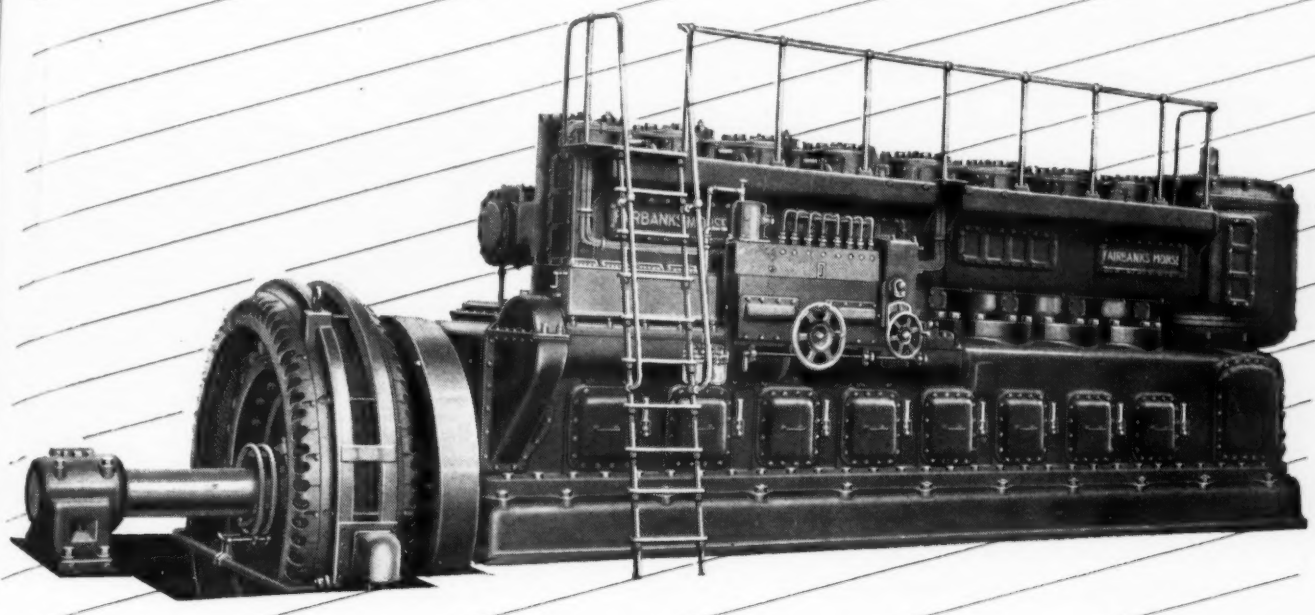
**CONDENSATE RETURN SYSTEM BUILT-IN** as an integral part of all boilers of 60 h.p. and up.

**CHOICE OF FUEL — GAS, OIL OR COAL** Whatever your fuel requirement is, there is a Steamaster Boiler to fill it. Use Gas, Oil or Coal or any combination.

**FULL RANGE OF SIZES** from 10 to 300 h.p. as illustrated. The Model A for 3½ h.p., 5 h.p. and 7½ h.p.

**FULLY EQUIPPED FOR AUTOMATIC OPERATION . . .** finest accessories.

**A.S.M.E. CODE—NATIONAL BOARD APPROVED . . .** Inspected and certified by Hartford Steam Boiler Inspection and Insurance Co.



# FAIRBANKS-MORSE DIESELS

**PROVED by Performance**

No more conclusive evidence of Fairbanks-Morse Diesel superiority exists than the actual records of their performance. In every instance, the story is the same: Fairbanks-Morse Diesels are sparing on fuel costs . . . ask minimum maintenance . . . have maximum reserve power . . . operate efficiently through sustained, heavy-duty service.

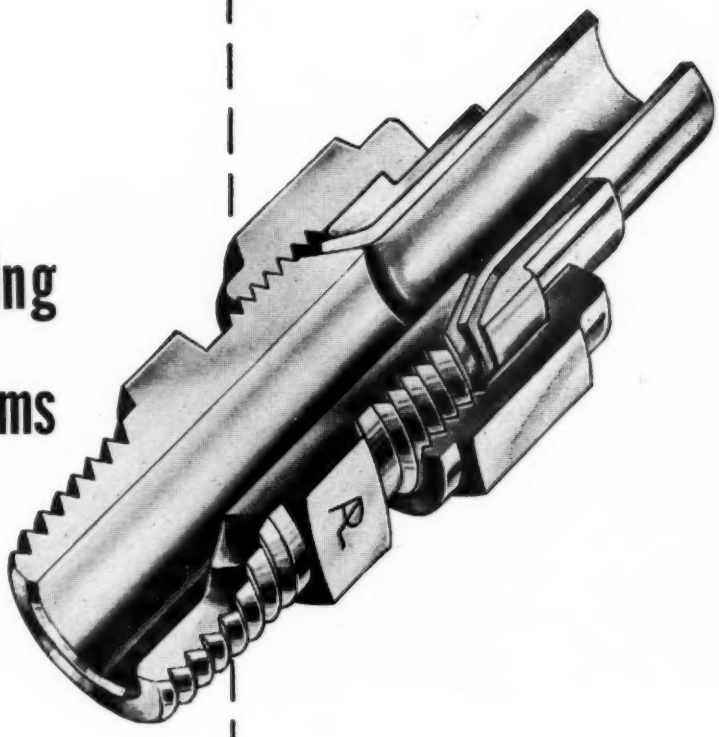
If more power—and lower power cost—are what you need, have a Fairbanks-Morse power engineer study your problem. No cost, no obligation—write now for particulars. Fairbanks, Morse & Co., Chicago 5, Illinois.

## Fairbanks-Morse

*A name worth remembering*

Diesel Locomotives
Diesel Engines
Generators • Motors
Pumps • Scales
Magnetos • Stokers
Railroad Motor Cars
and Standpipes
Farm Equipment

# This Parker Tube Fitting makes Free Flow systems possible



It takes *tubing* to achieve Free Flow. Tubing can be bent . . . can be connected without creating pockets that cause turbulence. Fewer fittings are required—resulting in fewer chances of leaks.

With PARKER Tube Fittings there's no threading on the tubing. You can use light or heavy tubing. Connections are pressure-tight—protected against leakage, vibration and shock—the result of **precision** manufacture.

With no threading on the job—installation and removal are quick and easy.

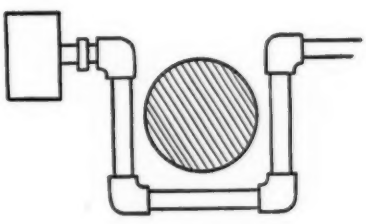
For simplified, Free Flow systems, use tubing with PARKER Fittings and Valves. And remember, *every* PARKER Fitting is a *coupling.*

Let PARKER work with you on your systems to carry liquids or gases, under high or low pressure.

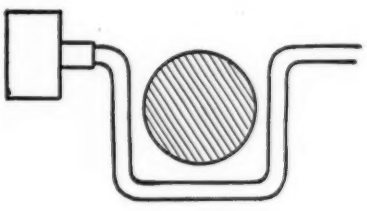
**THE PARKER APPLIANCE COMPANY**
**17325 Euclid Avenue • Cleveland 12, Ohio**
**Offices: New York, Chicago, Los Angeles, Dallas, Atlanta**
**Distributors in Principal Cities**

**Parker**
**TUBE FITTINGS • VALVES**

## FREE FLOW— a comparison



**OLD METHOD**—Each connection threaded—requires numerous fittings—system not flexible or easy to install and service. Connections not smooth inside—pockets obstruct flow.



**MODERN METHOD**—Bendable tubing needs fewer fittings—no "threading on the job"—system light and compact—easy to install or service—no internal pockets or obstructions to free flow.

***Write for interesting booklet "Fluid Power".***

**GO TO AN ASBESTOS EXPERT**
*When it's too hot to handle!*

**Where there is need for asbestos safety clothing, it is needless to say the *best* is needed . . . And you're sure it's best when it's Palmetto Asbestos.**

**Greene, Tweed & Co., manufacturers of famous Palmetto Asbestos products, are pleased to announce that Palmetto Asbestos Safety Clothing is again available. To meet the demands for many new types of gloves, mittens, aprons, coats and other garments, the line of standard products is now far more comprehensive than that which existed before the war.**

**Illustrated above are a few representative products. For literature covering the entire line or particulars on special safety clothing, write Department S—Greene, Tweed & Co., North Wales, Pa.**

**PALMETTO**
***Palco***

**NEVER SCORES FOR YOU**
***So you win!***

If you've been experiencing scored pump sleeves in centrifugals handling cold water, you've got the wrong packing in your line-up. Put Palmetto Palco in the box to bat for your side . . . This self-lubricating long staple cotton packing always makes a hit with chief engineers, master mechanics and maintenance men *because it cannot score!* Write today for more particulars on this and other famous packings on the Palmetto team.

PALMETTO Packings

**GREENE, TWEED & CO.**
***North Wales, Pennsylvania***

*In the United States and Canada There is a Distributor Near You*

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☐ Send literature please ☐ Send a representative please
NAME _____ TITLE _____
FIRM _____
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# Who solves your puzzles?

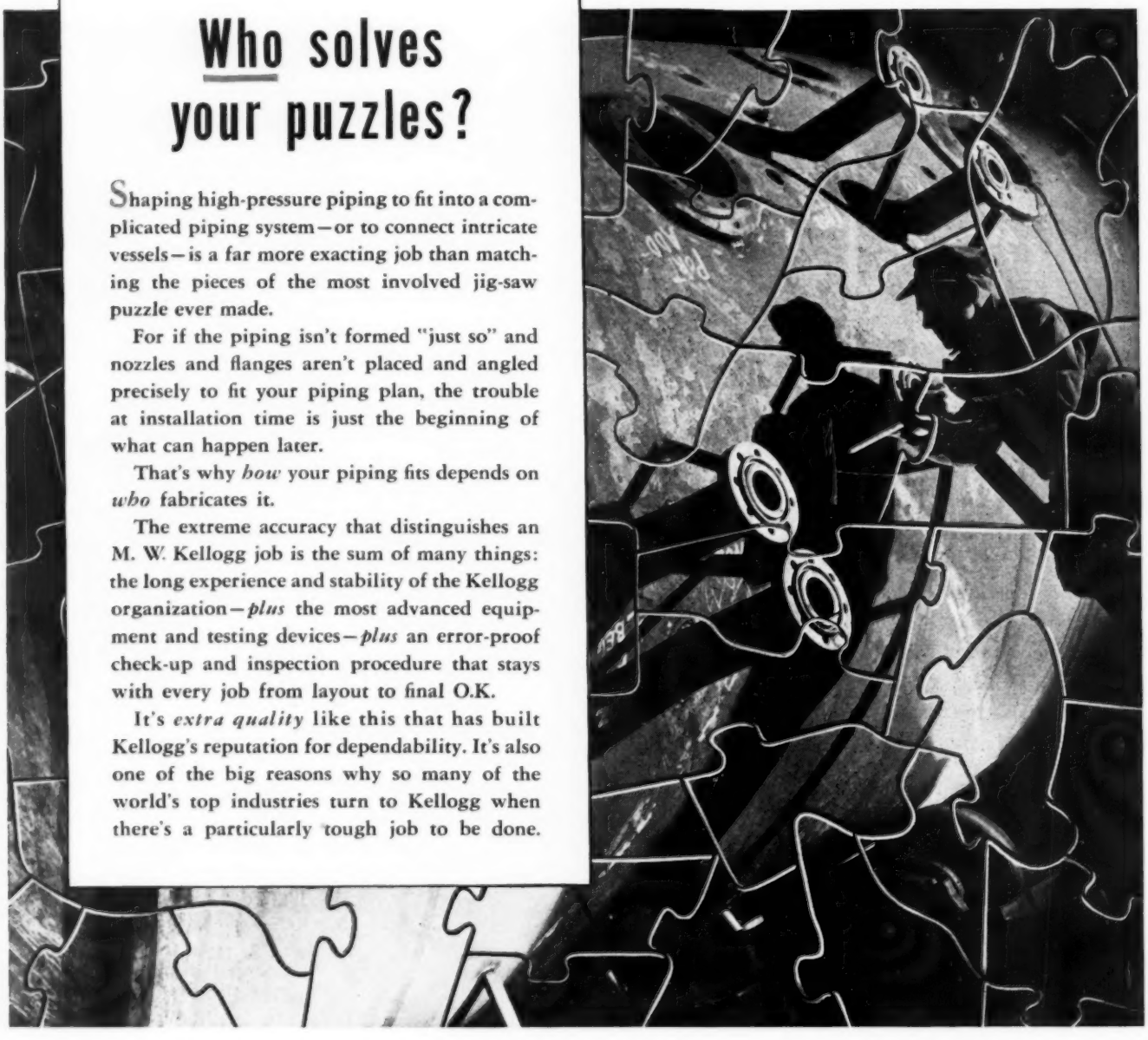
Shaping high-pressure piping to fit into a complicated piping system—or to connect intricate vessels—is a far more exacting job than matching the pieces of the most involved jig-saw puzzle ever made.

For if the piping isn't formed "just so" and nozzles and flanges aren't placed and angled precisely to fit your piping plan, the trouble at installation time is just the beginning of what can happen later.

That's why *how* your piping fits depends on *who* fabricates it.

The extreme accuracy that distinguishes an M. W. Kellogg job is the sum of many things: the long experience and stability of the Kellogg organization—*plus* the most advanced equipment and testing devices—*plus* an error-proof check-up and inspection procedure that stays with every job from layout to final O.K.

It's *extra quality* like this that has built Kellogg's reputation for dependability. It's also one of the big reasons why so many of the world's top industries turn to Kellogg when there's a particularly tough job to be done.



FABRICATED PRODUCTS DIVISION

## THE M. W. KELLOGG COMPANY

*NEW YORK • JERSEY CITY • BUFFALO • LOS ANGELES*
*TULSA • HOUSTON • TORONTO • LONDON • PARIS*

**VESSELS • EXCHANGERS • CONDENSERS • HIGH PRESSURE AND HIGH TEMPERATURE POWER PIPING**
**PROCESS PIPING • FORGED AND WELDED FITTINGS...IN ALL STEELS, ALLOYS OR SPECIAL COMBINATIONS**

**Metallurgical Research** conducted continually by recognized specialists who have made major contributions in this field.

**Unique Technical Backing** of an extensive organization with an international reputation in both process and fabrication engineering.

**Complete Facilities** for the fabrication of steel products from simple forgings to the most intricate 120 foot towers.

**Quality Control** embracing the constant application of the most advanced inspection methods, both visual and non-destructive.

**On-Time Delivery** made possible by a flexible planning group authorized to re-route work to meet promised dates.

**Top Welding Performance** assured by specially designed equipment and exclusive employment of master operators.

# Practical

## FOR HIGHER TEMPERATURES

NORTON REFRACTORIES are practical for higher temperatures because they are **special refractories,** and that's what special refractories are made for: *heavy duty work at high temperatures.*

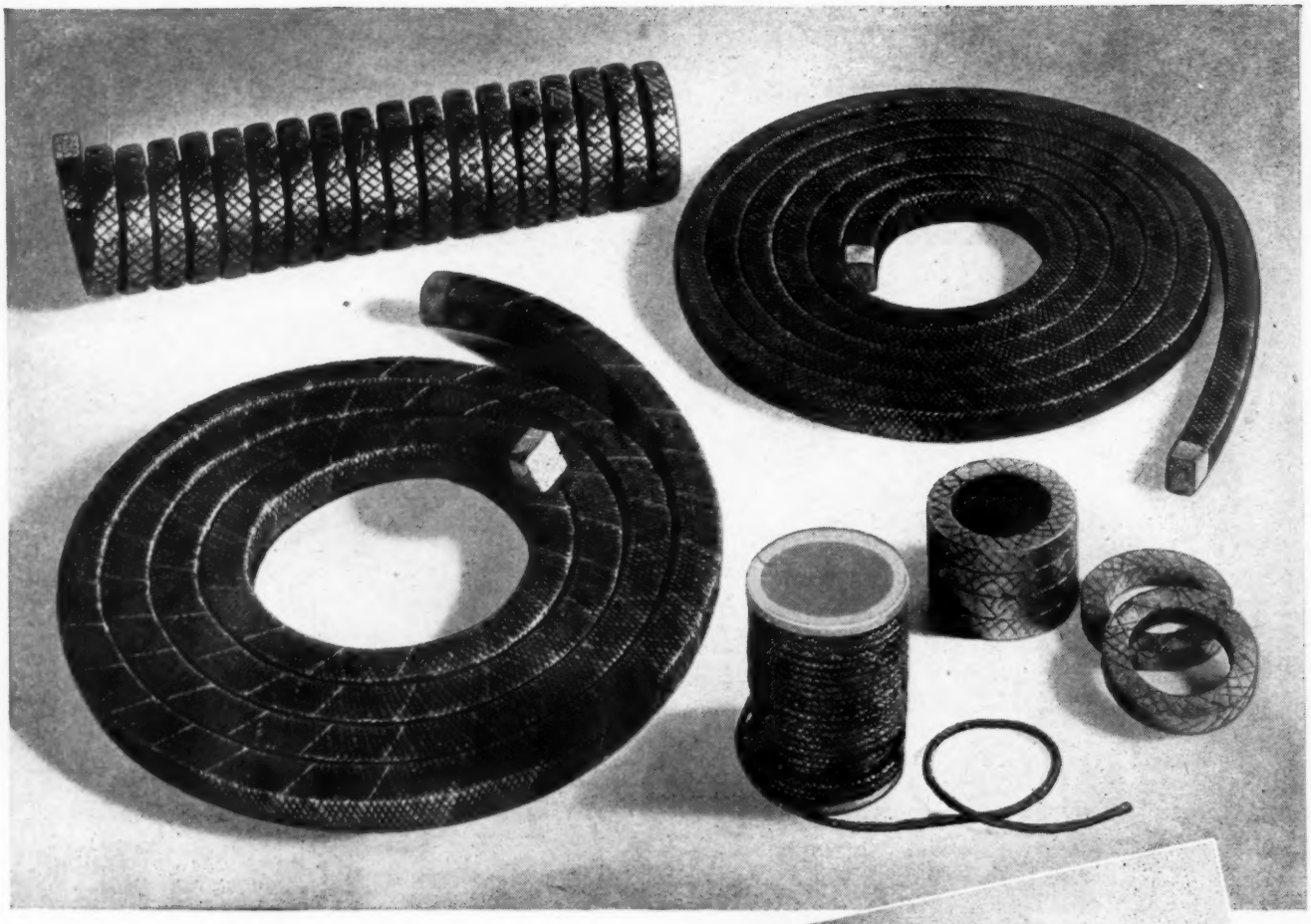
The five qualities of special refractories as manufactured by Norton Company are:

1. high refractoriness at elevated temperatures,
2. great physical strength — even at high heat,
3. chemical stability giving resistance to slag,
4. excellent heat transfer properties,
5. resistance to abrasion and to slag penetration.

If the refractories you are using now are not suited to long service at the temperatures at which your plant is operating, or if higher operating temperatures are desired, then investigate the benefits to be gained from using special refractories by writing to:

**Refractories Division, Norton Company**
**Worcester 6, Massachusetts**

NORTON COMPANY, WORCESTER 6, MASS.



# Saves Time and Money!

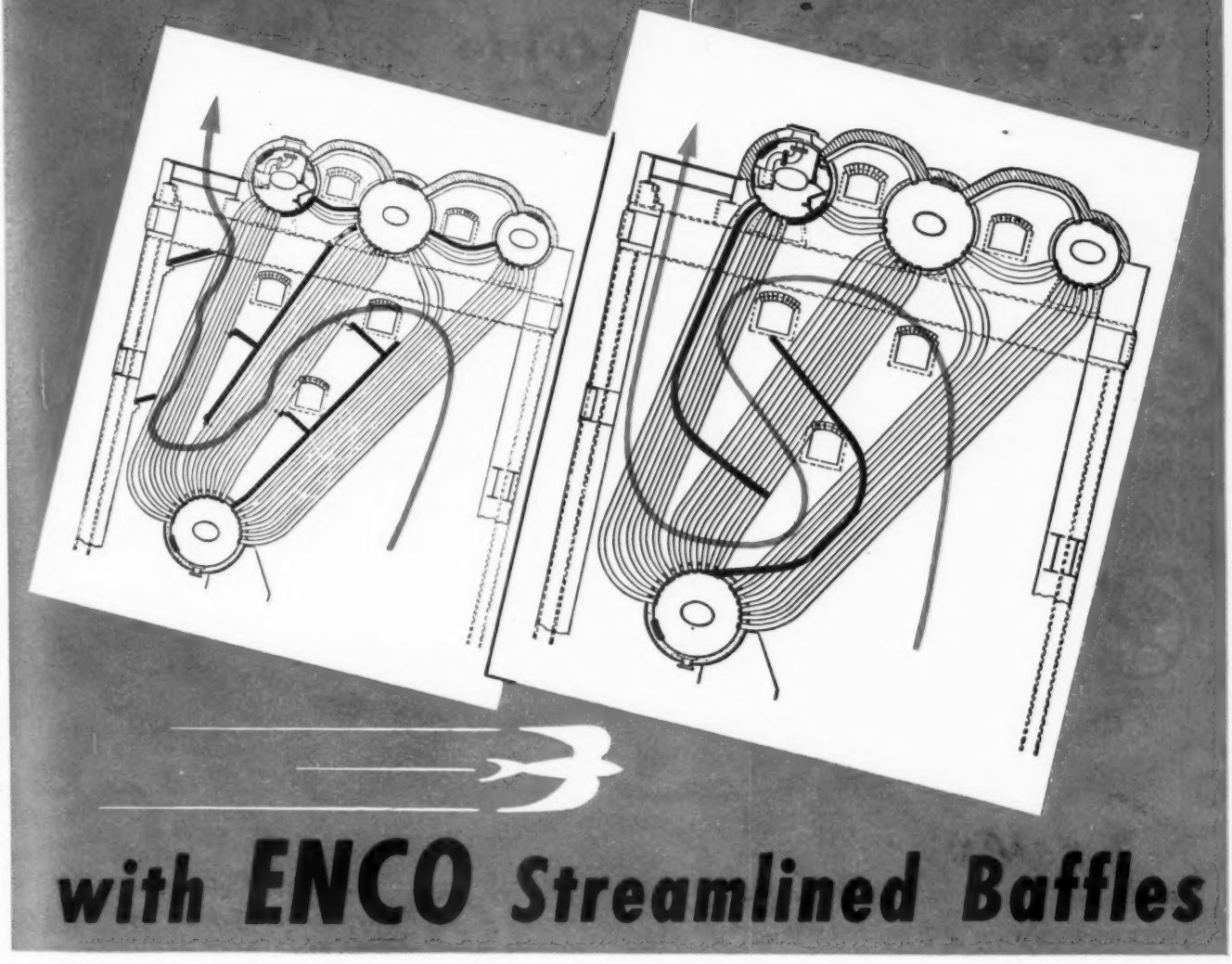
GARLOCK *Plastallic* packing is easy to apply. You just tamp the loose form into the stuffing box and draw up on the gland. Coil, spiral and ring forms are applied in the usual way. And when additional packing is needed, you merely back off the gland and add more *Plastallic*. In service it combines into one homogenous mass. A special feature of GARLOCK *Plastallic* coil packing is that it is out-of-square to fit either of two different packing spaces. Save time and money with *Plastallic!*

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.

**GARLOCK 924 PLASTALLIC**—for strong mineral acids.
**GARLOCK 926 PLASTALLIC**—for water, steam or air up to 550° F.
**GARLOCK 927 PLASTALLIC**—for gasoline, oils, ether, etc., up to 550° F.
**GARLOCK 928 PLASTALLIC**—for steam, oils or solvents up to 700° F.
**GARLOCK 929 PLASTALLIC**—for water, steam and general services up to 550° F.
**GARLOCK 930 PLASTALLIC**—for gasoline, oils, gases, etc., at temperatures up to 700° F.
**GARLOCK 931 PLASTALLIC**—for steam, water or air at temperatures up to 700° F.

# GARLOCK *Plastallic*

# Designs for Increasing Steam Output



# with ENCO Streamlined Baffles

These diagrams show how improved baffle design assures a uniform, high velocity gas flow over every square foot of heating surface. How the baffles are smoothly curved to maintain a cross-flow of gases across the tube banks. With ENCO Streamlined Baffles, bottle-necks, dead gas areas, and soot pockets are eliminated; draft-loss is cut to a minimum. The result—more efficient, economical heat transfer.

Power Engineers continue to report that in installation after installation, ENCO Streamlined Baffles are far exceeding their expectations in reducing fuel consumption, furnace maintenance, and increasing steam output.

Especially engineered to suit each individual water-tube boiler, and installed by experienced ENCO crews, ENCO Streamlined Baffles provide for easy tube replacement, low maintenance cost, adaptability to bent tube boilers.

If you want a higher efficiency from your boilers —and a substantial increase in steam output, see your ENCO representative! The 18-page ENCO Bulletin, BW-44, fully describes the profit-proved advantages. Write for your free copy today!

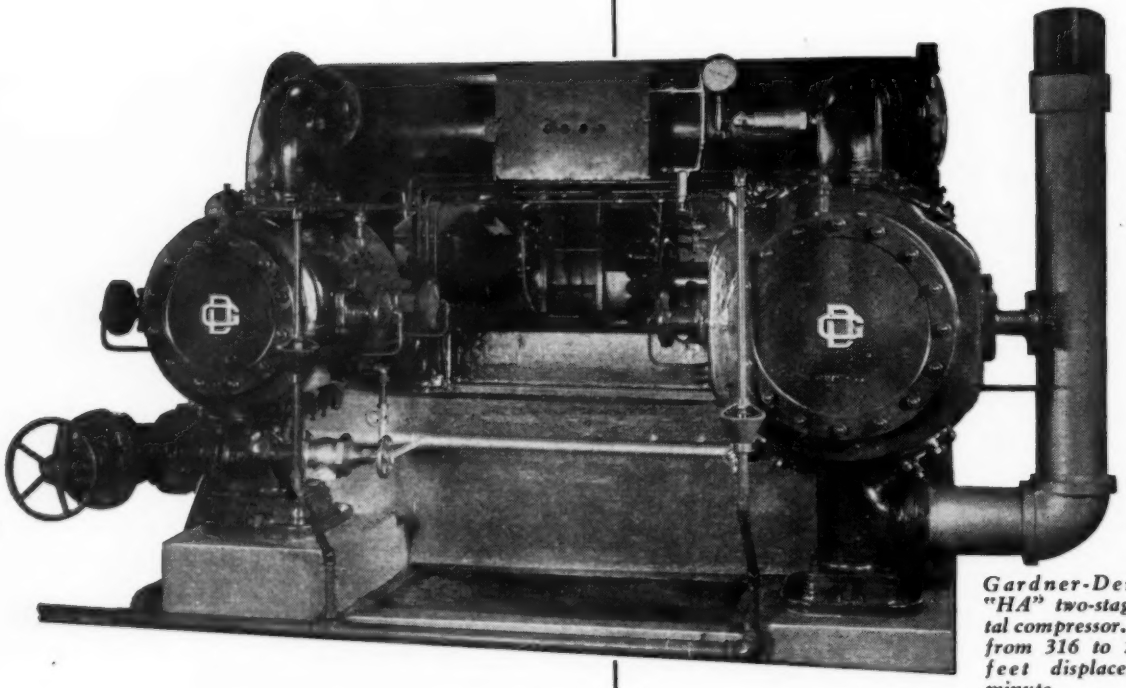
EC-469

THE ENGINEER COMPANY
*Also Produces*
Enco Oil Burners
Enco Fuel Oil Pumping and Heating Units
Enco Automatic Oil-Electric Ignition System
Enco Automatic Combustion Control

**THE ENGINEER COMPANY**

75 West Street, New York 6, N. Y.
*Canadian Representative*
F. J. Raskin Ltd., 370 Rachel E., Montreal, P. Q.

# "to what do you attribute YOUR LONG LIFE?"



*Gardner-Denver Class "HA" two-stage horizontal compressor. Capacities from 316 to 2012 cubic feet displacement per minute.*

WHY do Gardner-Denver "HA" Horizontal Compressors last so long — maintaining their high efficiency after years of service? One reason is that in these compressors, shaft friction and wear have practically been eliminated. Timken roller main bearings provide permanent rigidity with freedom from bearing vibration, pounding and side thrust. Bearings will run indefinitely without adjustment, but when take-up is necessary, they may easily be adjusted with assurance that the main shaft will be in line. Here are other reasons why you'll want a Gardner-Denver "HA" in your plant—

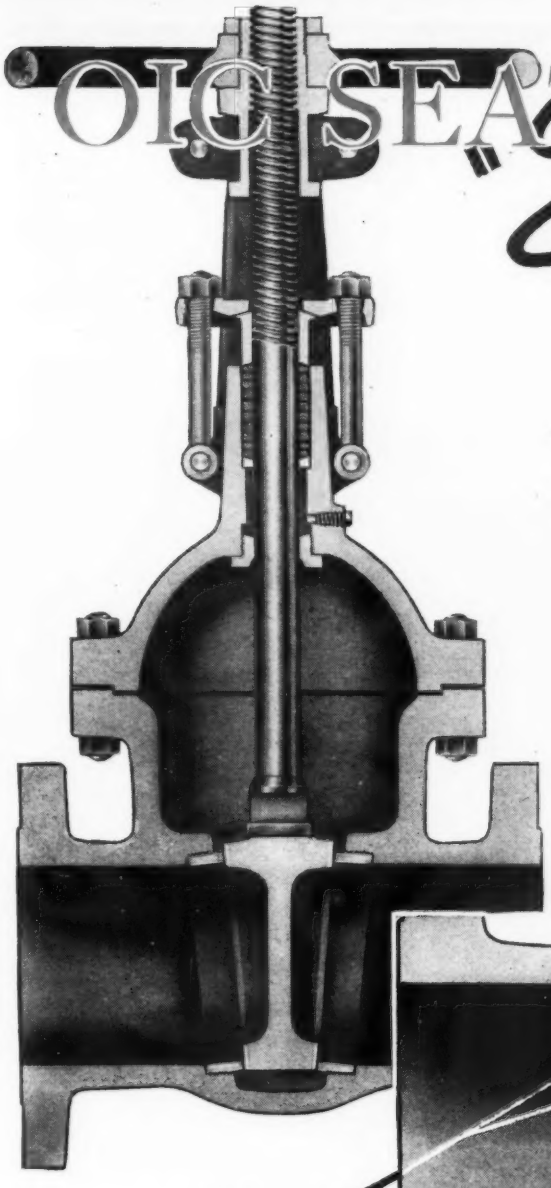
- *Duo-Plate cushioned valves for high delivery capacity — high compression efficiency and lowest power consumption.*
- *Air cylinders designed for highest volumetric efficiency and lowest horsepower requirements.*
- *Large water jacket areas for cooler running . . . lower discharge temperatures and lubricating economy.*
- *Heavy-duty massive main frames, heavily ribbed and reinforced for maximum strength and rigidity.*
- *Five-step capacity control regulates air output to suit your air needs.*

For complete information, write
Gardner-Denver Company, Quincy, Illinois.

# GARDNER-DENVER

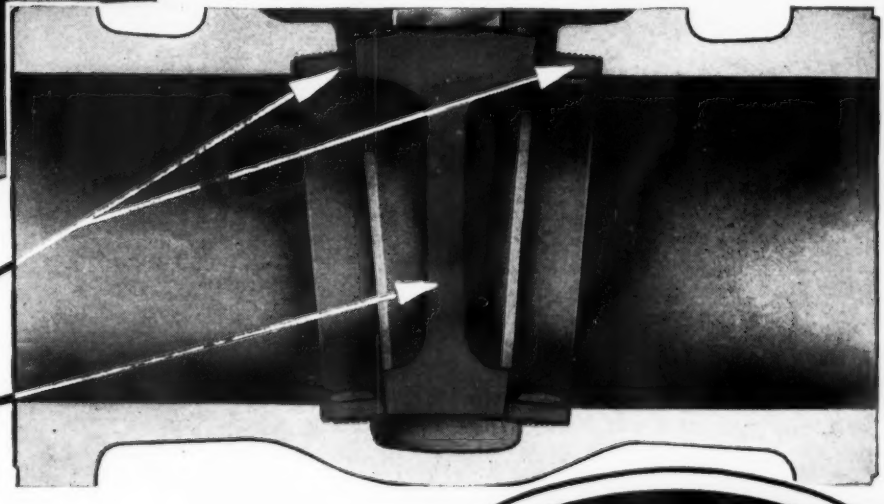
SINCE 1859

# OIC SEAT RINGS "Sit tight"



TO STOP LEAKS, get your steel gate valves from OIC, designers of a modern and *different* type of seat ring that *"stays put"* even under severest service conditions! In this advanced OIC design, the ring is "backed up" by the solid wall of the valve body, as shown in the diagram. That means that even if the wedge is accidentally jammed hard against it, this ring cannot tilt, shift or loosen. In fact, any force against the OIC seat rings presses them more tightly in place against the body wall!

Another advantage of this OIC design is that it makes possible a thread area *considerably greater* than that found on most conventional seat rings in the same size of valve. All this means positive tightness . . . protection against rough usage . . . less maintenance . . . longer life . . . true economy.




*See the new* OIC *film*

Don't miss OIC's new sound slidefilm, "OIC Sets The Pace In Valves!" It's designed to give you the latest, most up-to-date information available on valve manufacturing and valve use. If you would like a private showing in your office—no obligation, of course—just write, giving your name, title and Company, to: **The Ohio Injector Co., Wadsworth, Ohio.**

OIC

VALVES

**STEEL • IRON • BRONZE**

O-847-3

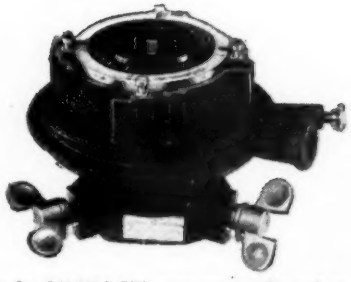
# . . . at the time of the FIRST TOLEDO pipe tools

This is the 1903 Ford — the first of a long line of production cars which Henry Ford built. It was in 1903 that he organized the Ford Motor Company. Previously, as chief engineer of the Detroit Automobile Company, he had produced several outstanding racing cars.

The recent death of Henry Ford marked the passing of one of the great leaders in motor car progress.

★ ★ ★

It was in those early days of "horseless carriages"—45 years ago—that TOLEDO Pipe Tools were first being produced. In their field . . . they, too, became leaders. Demand for these easy-threading, dependable Pipe Tools has grown steadily through the years. The line of four basic threaders introduced in 1902 has expanded to the wide range of TOLEDO-Engineered Pipe Tools and equipment of today. The Toledo Pipe Threading Machine Company, Toledo, Ohio. New York Office, No. 2 Rector Street Bldg.



Toledo SIMPACT—an example of outstanding design and performance! A self-contained, adjustable threader for 1" to 2" pipe. Sizes changed instantly with one set high speed steel dies. Accurate, dependable.

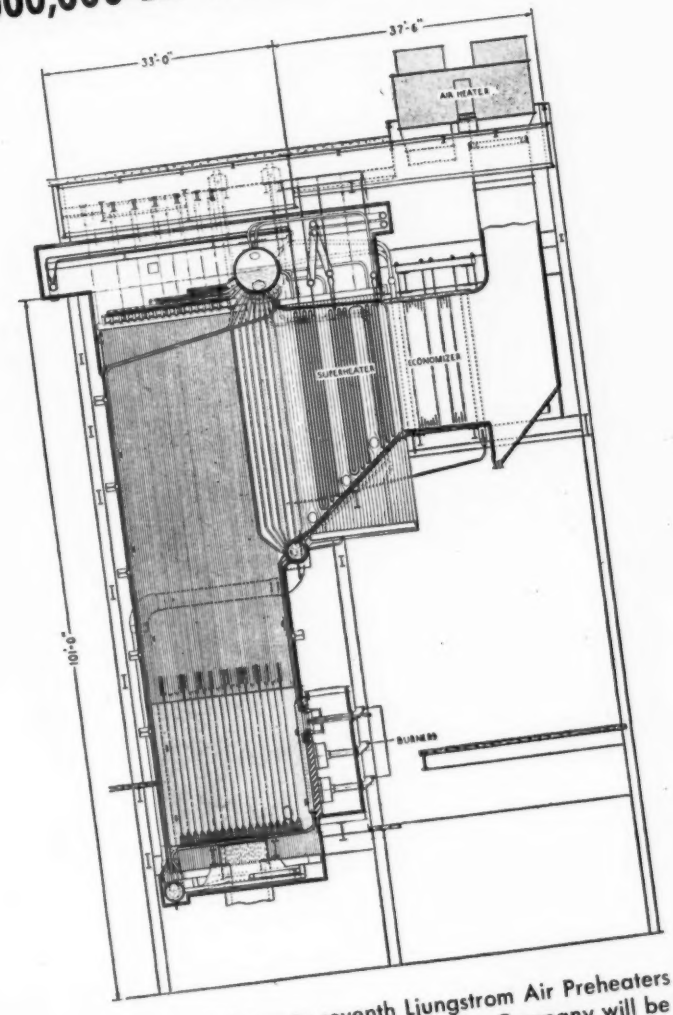
"TOLEDO"
TRADE-MARK REGISTERED

**TOLEDO** PRECISION PIPE TOOLS

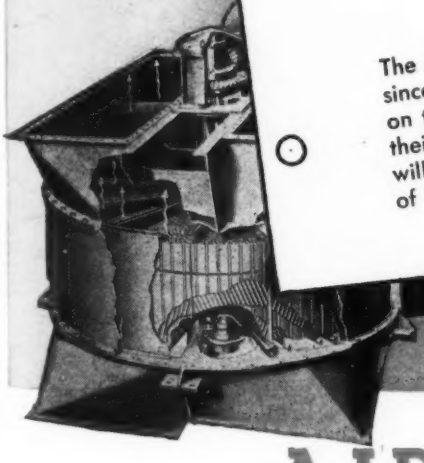
# ENGINEERING PROGRESS REPORT #14

## LJUNGSTROM AIR PREHEATER

### NEW 1,000,000-LB. STEAM GENERATING UNIT




The twenty-sixth and twenty-seventh Ljungstrom Air Preheaters ordered since 1927 by Public Service Electric and Gas Company will be installed on the new 1,000,000 pounds per hour Babcock and Wilcox boiler in their Essex Generating Station at Newark, N. J. These two Ljungstroms will supply preheated air at 730 F. with full-load exit-gas temperature of 347 F.



THE

# AIR PREHEATER

CORPORATION

**Executive Offices: 60 East 42nd Street, New York 17, N. Y. • Plant: Wellsville, N. Y.**

This huge aircraft plant, roofed and sided with "Century" Asbestos Corrugated, will withstand a lifetime of service without maintenance or deterioration.

# ASBESTOS IN ACTION

"Century" Asbestos Corrugated is easy to drill and cut on the job.

## WHAT OTHER SHEATHING MATERIAL GIVES YOU ALL THESE ADVANTAGES?

If you're planning some new industrial construction, or remodeling, it will pay you to look into the advantages of K&M "Century" Asbestos Corrugated. Compare these features with those of any other roofing and siding material:

**1.** FAST, ECONOMICAL CONSTRUCTION—19 available sheet sizes speed up installation. New "Topside" fasteners eliminate costly scaffolding on roof jobs, as *all* fastening can be done from atop the roof's surface.

**2.** STRUCTURAL STRENGTH—"Century" Asbestos Corrugated withstands severe stresses, such as snow loads, other common conditions.

**3.** IMMUNITY to fire, weather, rust, corrosion, galvanic action. Being made of asbestos and cement, "Century" Corrugated cannot fall victim to these damaging forces.

**4.** ATTRACTIVE APPEARANCE—pleasing light gray color provides attractive, modern appearance . . . banishes that forbidding "gloom" so characteristic of many industrial plants in the past.

**5.** FREEDOM FROM MAINTENANCE—"Century" Asbestos Corrugated never needs painting, is highly resistant to oil, acids, brine, other destructive agents.

•

Truly, here is the material adapted to today's industrial construction needs. You'll find it ideally suited to the job you have in mind. If you'd like to know more about it, just write us—we'll give your inquiries prompt consideration.

*Nature made Asbestos*
*Keasbey & Mattison has made it serve mankind since 1873*

K&M best in asbestos

Reg. U. S. Pat. Off.

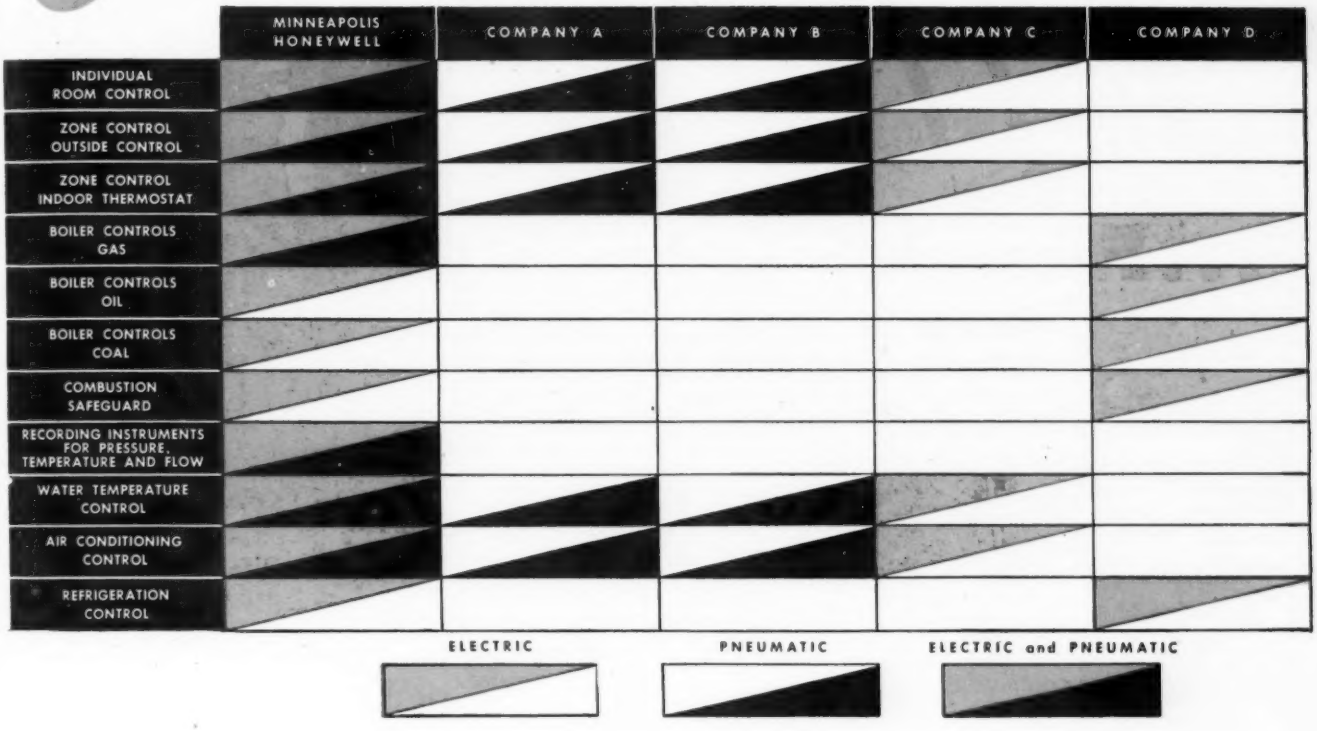
# KEASBEY & MATTISON

## COMPANY • AMBLER • PENNSYLVANIA

*IN CANADA*—ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG and VANCOUVER

# ONLY HONEYWELL gives you

# *Controls for Every Purpose!*




THE chart tells the story! Only Minneapolis-Honeywell can supply a complete line of both electric and pneumatic controls for every factory requirement. Think what this means from your standpoint. All your controls from one manufacturer means uniformity of design and quality . . . and standardization means efficiency. It's the same manufacturer —Minneapolis-Honeywell—who is able to give you unbiased advice, based on broad engineering experience, about every type of control. And Honeywell maintains a nation-wide staff trained to provide service from plan stage throughout the life of every installation, electric or pneumatic.

Backing this comprehensive operation is the Honeywell reputation for dependable performance, established for over 60 years. Benefit by standardizing with Honeywell—the leader . . . Minneapolis-Honeywell, Minneapolis 8, Minnesota . . . In Canada: Toronto 12, Ontario.

MINNEAPOLIS **Honeywell**

CONTROL SYSTEMS

# Oxygen ...FRIEND OR FOE?

*(Turbine Oil Oxidation Test)*

**Without oxygen, man cannot live. Yet, reaction to oxygen may shorten the service life and destroy the value of a lubricant!**

**Sinclair is ever alert to the importance of knowing exactly how oils will resist oxidation which can form gums and sludge detrimental to equipment performance.**

**No satisfactory, quick, short time oxidation test methods have yet been developed. Sinclair Research does not compromise. Some studies require continuous tests of 1000 hours. Others, performed with the apparatus above, are run for 100 hours or more.**

**This test — to assure consumers that breakdown and resultant costly repairs due to oxidation will be at a minimum — constitutes one safeguard against inferior product performance . . . just as all Sinclair Research is your assurance that every Sinclair Industrial Lubricant is the very highest in quality.**

*Sinclair Power Plant Oils*

For Turbines:

**SINTURLITE OILS**

Oxidation stability, rust prevention, long life

For Compressors:

**RUBILENE OILS**

In grades to suit all operating conditions

From selected crude processed to quality finish

SINCLAIR REFINING COMPANY • 630 FIFTH AVENUE, NEW YORK 20, N. Y.

**SINCLAIR**

*Lubricants for Industry*

FINEST CRUDES + EXPERT RESEARCH and MANUFACTURING CONTROL = OUTSTANDING PERFORMANCE

B-55-G

*Governor Type Slow Opening Gas Valve*

**GENERAL CONTROLS**

**801 ALLEN AVENUE, GLENDALE 1, CALIFORNIA**

*Manufacturers of Automatic Pressure, Temperature & Flow Controls*

**FACTORY BRANCHES:** PHILADELPHIA • ATLANTA • BOSTON • CHICAGO • DALLAS
KANSAS CITY • NEW YORK • DENVER • DETROIT • CLEVELAND • PITTSBURGH
HOUSTON • SEATTLE • SAN FRANCISCO • **DISTRIBUTORS IN PRINCIPAL CITIES**

*FOR ALL MAJOR SERVICES*
*IN PRINCIPAL INDUSTRIES*

# Walworth Valves and Fittings

***assure low cost dependable performance***

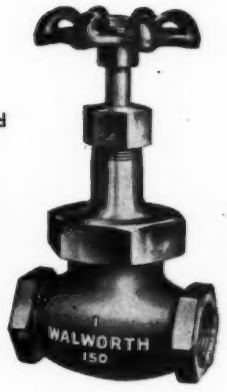
Walworth manufactures a **complete line** of valves and pipe fittings for ALL major services in principal industries. All Walworth products are made to the highest standards of quality, both as to dimensional accuracy and metallurgical properties. In design, construction, and performance, they reflect Walworth's 105 years of "know how" in the manufacture of quality valves and fittings.

Your Walworth distributor will give you full information on the **complete line** of Walworth steel, iron, and bronze valves, and pipe fittings; also Walworth Lubricated Plug Valves, and Walseal* valves, fittings and flanges. Ask for this information today.

*Patented—Reg. U. S. Pat. Off.

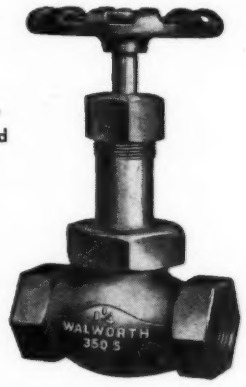
## WALWORTH
### valves and fittings
**60 EAST 42nd STREET, NEW YORK 17, N. Y.**

DISTRIBUTORS IN PRINCIPAL CENTERS
THROUGHOUT THE WORLD




No. 95
150-Pound
Bronze
Valve

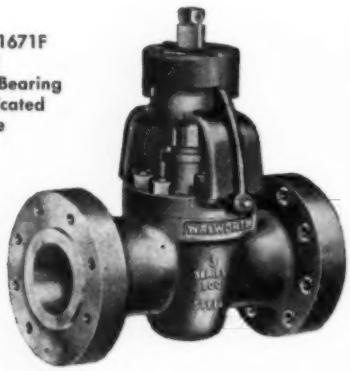
Renewable Disc




No. 225P
350-Pound
Bronze
Valve

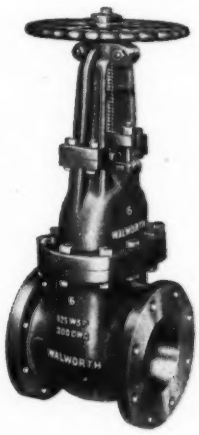
"500 Brinell" Seat & Disc

No. 709
Iron Body
Saddle
Gate
Valve



No. 1671F
Steel
Ball Bearing
Lubricated
Valve
Plug

Pressure-
Seal
Steel
Valve




No. 726F
Iron Body
Wedge
Gate
Valve

# Remember These Points About FAST'S...

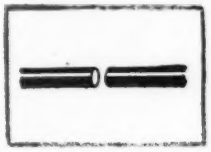
## and you can Forget about Coupling Shutdowns

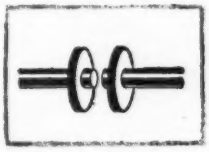
### *Exclusive* Metal-to-Metal Seal Gives You *Extra* Protection

The surest way to stop coupling shutdown worries is to install Fast's Couplings in your plant. For one thing, the *exclusive* "rocking bearing" shown above makes a positive metal-to-metal seal for the load-carrying oil . . . permanently protecting it against wear-producing moisture, dust and grit. No perishable packing rings are used. There's nothing to wear, nothing to fail. The coupling is all-steel throughout—without a single perishable part.

Remember: Fast's self-aligning Couplings are the *original* gear-type couplings. Years of design and manufacturing experience go into every one . . . to give you uninterrupted power transmission . . . to lengthen machine life, lower upkeep costs, minimize shutdown losses.

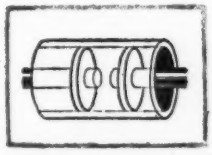
***We have a full complete line of couplings for immediate delivery.*** Get full details on Fast's Couplings now. Write today for your free copy of our complete catalog. Address: Koppers Company, Inc., Fast's Coupling Dept., 247 Scott Street, Baltimore 3, Md.

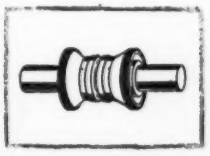


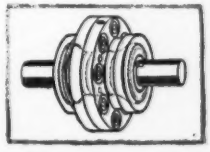


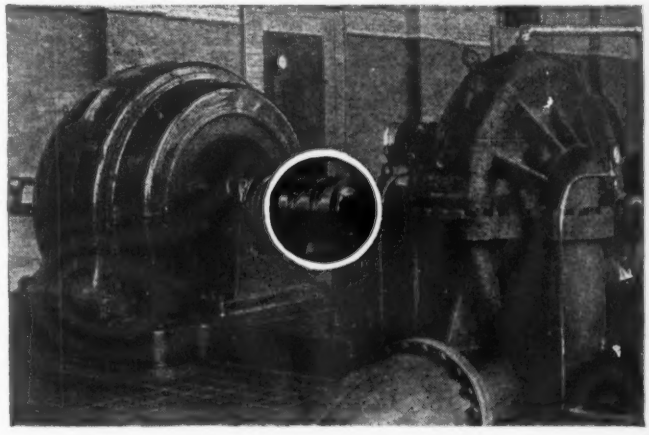
### Fast's Couplings Are Simple as A-B-C

See the simple development of Fast's Couplings. A splined hub on each shaft end, a sleeve with internal splines to mesh. Oil in the sleeve carries the load between the splines.





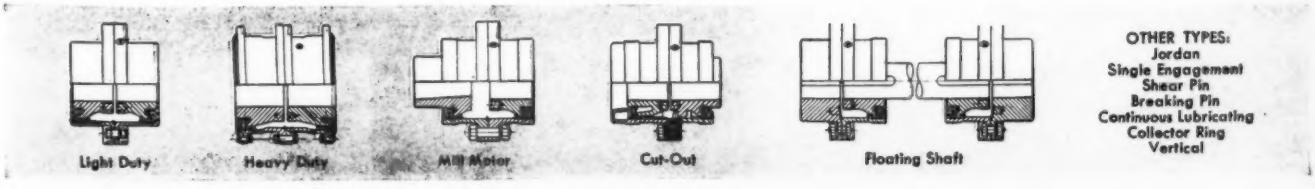




**THIS NO. 6 FAST'S COUPLING** connects an 1800 h.p., 600 r.p.m. motor to a 30 million gallon (per 24 hrs.) pump at the City of Montreal Pumping Station.

KOPPERS

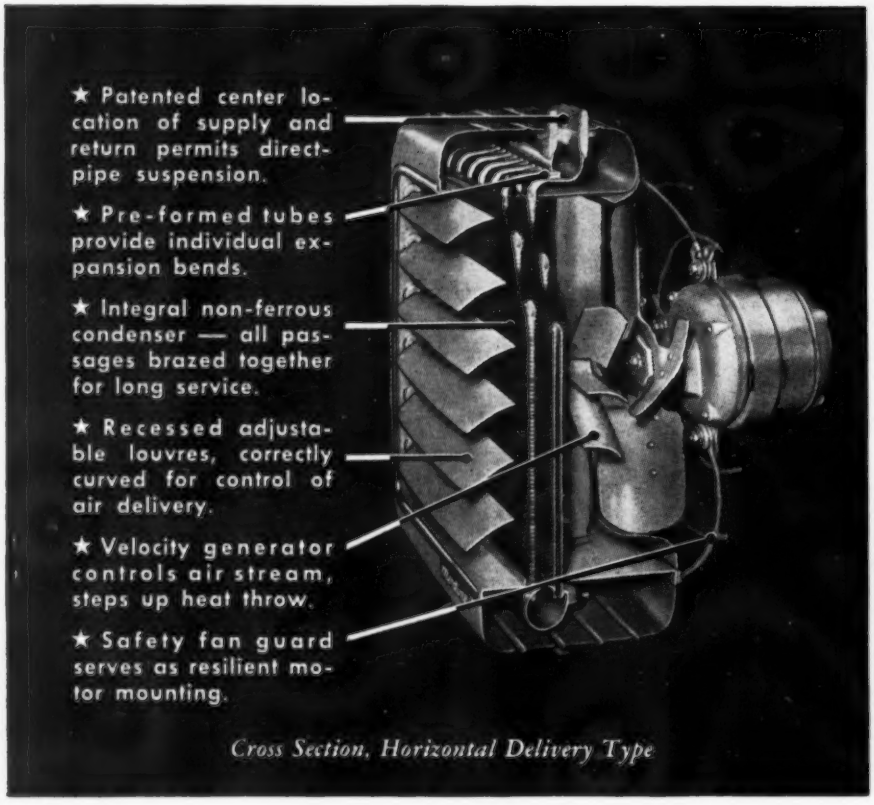
# FAST'S *self-aligning* COUPLINGS




OTHER TYPES:
Jordan
Single Engagement
Shear Pin
Breaking Pin
Continuous Lubricating
Collector Ring
Vertical

# INSIDE STORY

## on the great new 1947 Modine Unit Heater Line!


★ Patented center location of supply and return permits direct-pipe suspension.
★ Pre-formed tubes provide individual expansion bends.
★ Integral non-ferrous condenser — all passages brazed together for long service.
★ Recessed adjustable louvres, correctly curved for control of air delivery.
★ Velocity generator controls air stream, steps up heat throw.
★ Safety fan guard serves as resilient motor mounting.

*Cross Section, Horizontal Delivery Type*

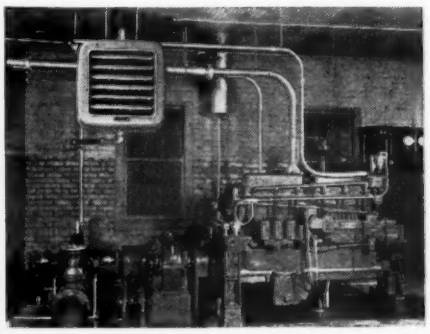
MODERN, up-to-the-minute style and beauty . . . improved heating performance . . . a broad new range of installation opportunities—that's what you get with the new 1947 Modine Unit Heater Line! Yes, and all these extra benefits add up to increased heating comfort, stepped-up operating efficiency for plants and stores!

Designed to meet the space heating needs of practically all modern industrial and commercial buildings, the new line of Modine Unit Heaters offers you three separate and distinct types, developed as a matching, integrated line with *47 basic capacities:* 1) Horizontal Delivery Type for general industrial applications — 2) Vertical Delivery Type for overhead installations — 3) New Power Throw Type for specialized industrial use.

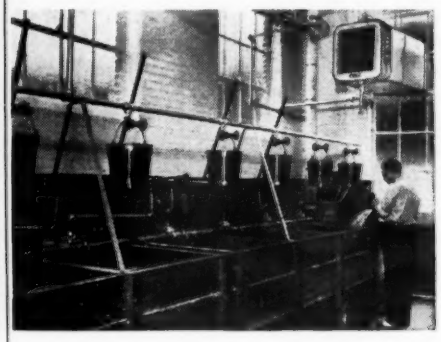
Never before has propeller unit heater design been so closely adapted to the expanding application of unit heating . . . or to the critical requirements of unit heater application engineers. If you're planning to build a new plant or store, investigate the Modine line. For complete information, see the "Where-to-Buy-it" section of your phone book, or write for free descriptive literature.

**Modine UNIT HEATERS**

## *Unit Heating News*



**STOP HEAT WASTE!** Unit heaters can be profitably used to recover and distribute waste heat generated by Diesel engines. Jacket water from Diesels is circulated through unit heaters, which transfer waste heat from the water to air and distribute it into areas requiring heat. Result: A two-way benefit — 1) unit heater cools jacket water, 2) heats room.

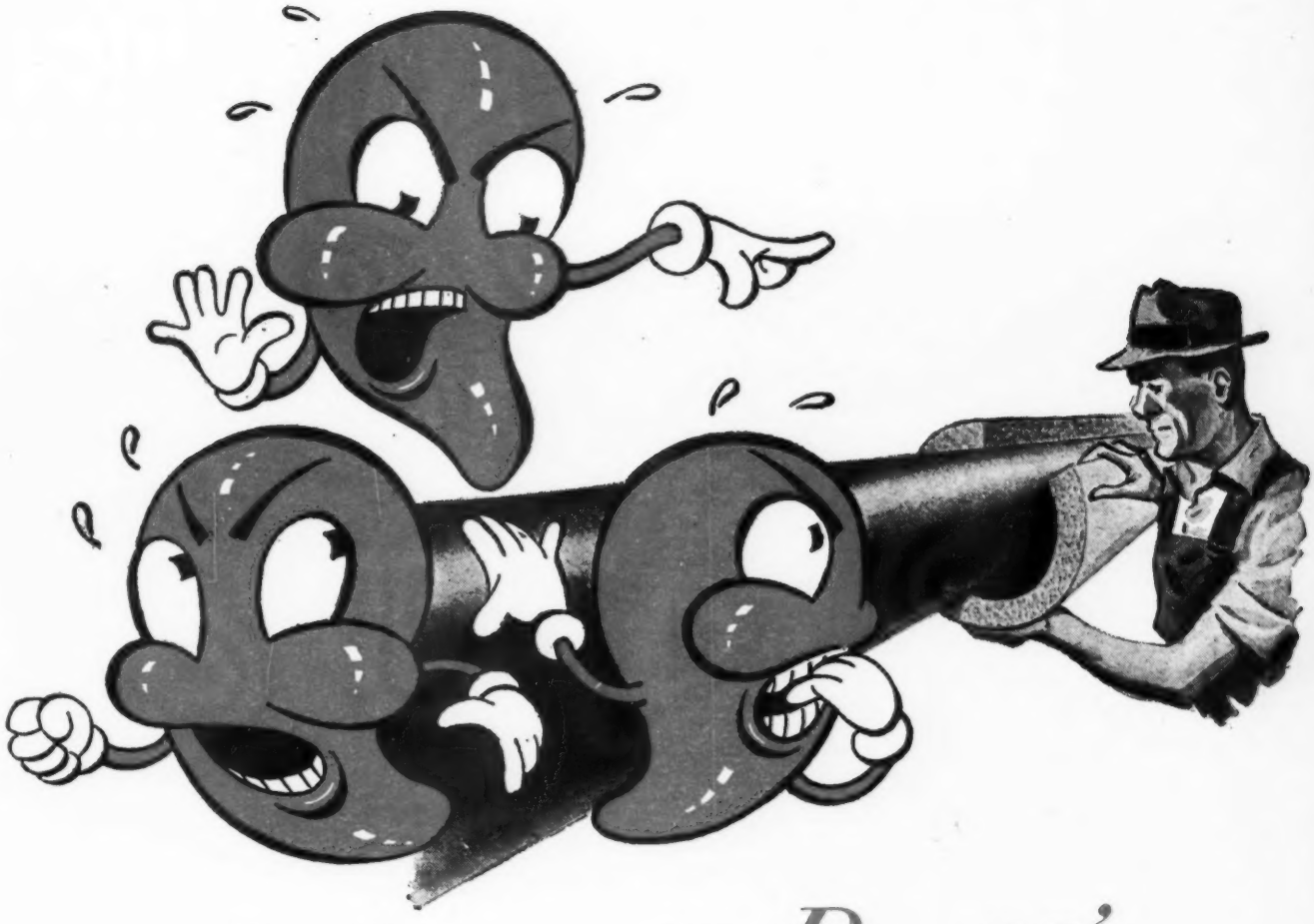


**FRESH AIR** protects health! A supply of clean, fresh air can easily and inexpensively be introduced into a room, heated and distributed by a unit heater as shown above. Discharge temperature of delivered air may be thermostatically controlled. Today, more and more industrial and commercial users are also taking advantage of unit heater systems in spring and summer months. By operating only the fans, it is possible to provide well-planned, cooling air circulation throughout an entire factory or store without the need for installing independent fan equipment at random locations.

### Important:

Right now, in the face of material shortages, we are doing our utmost to meet the tremendous demand for Modine Unit Heaters. If there is delay in filling your order, please be patient. When your new Modines are installed, we think you'll agree they were well worth waiting for.

**MODINE MFG. CO.**
1830 Racine Street, Racine, Wisconsin



# *bad news for BTU's*

When **CAREY** Heat Insulation comes into the picture, high-priced BTU's know play days are over. From then on, it's less shirking, more working. Heat energy will be held on the job to do a job, instead of sneaking through bare surfaces or inadequate insulation barriers.

**THAT CUTS COSTS!** And with today's driving emphasis on savings in production rather than on production at any price, it's a mighty important consideration for everyone. That's why *no one* can afford to take insulation conditions in *any* plant for granted.

That's also why you'll want to make full use of **CAREY'S COMPLETE INSULATION SERVICE.** Seventy-four years of experience ...well-rounded insulation engineering service... warehouse stocks from coast to coast... a complete line of insulations for industrial needs...that's what you get when you call in **CAREY** on an insulation job.

If you have an immediate insulation problem we'll be glad to help. In any event you'll want to...

**WRITE FOR YOUR FREE COPY** ...of this helpful booklet. It's an excellent guide to selection of proper insulation, contains specifications and tables you want handy for ready reference. Gives a complete picture of the **CAREY** Heat Insulation line, too. A *free* copy of "Heat Insulation for Industry" is yours for the asking. In requesting yours, address Dept. 000.

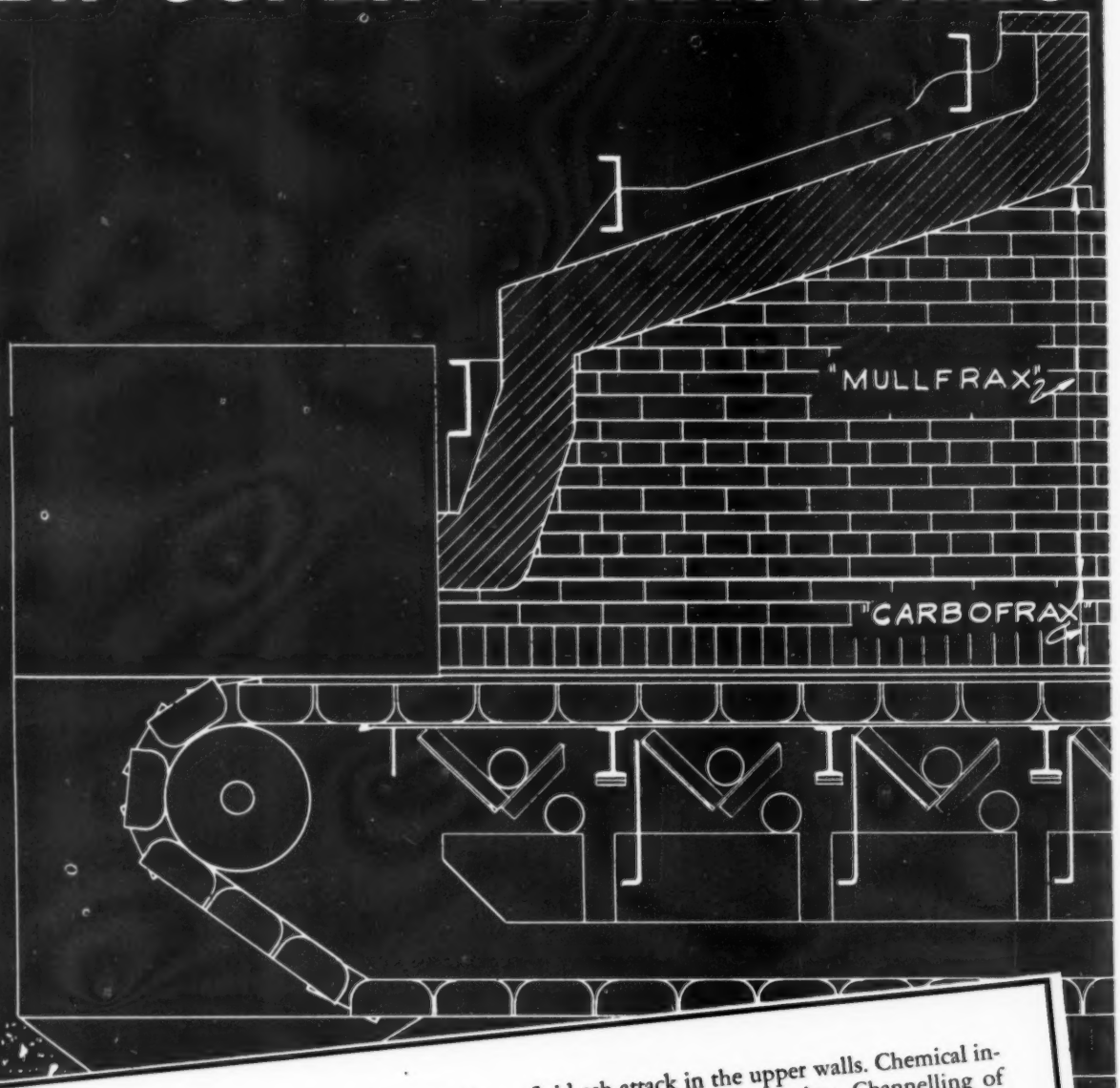
**Carey**

**THE PHILIP CAREY MANUFACTURING CO., CINCINNATI 15, OHIO**

**In Canada: The Philip Carey Co., Ltd.**
**1557 MacKay Street, Montreal 1, P. Q.**

**Industrial Insulation • Rock Wool Insulation**
**Careyduct • Asbestos Wallboard & Sheathing**
**Asphalt Shingles & Roofings • Built-up Roofing**
**Roof Coatings and Cements • Pipeline Felt**
**Asphalt Tile Flooring • Waterproofing Materials**
**Expansion Joint • Asbestos Shingles & Siding**
**Corrugated Asbestos Roofing and Siding**
**Miami-Carey Bathroom Cabinets & Accessories**

# NEW SUPER REFRACTORIES




A COMBINATION of super refractories by CARBORUNDUM is used to alleviate troublesome, costly conditions encountered in furnaces burning high pyritic sulphur coals.

CARBOFRAX silicon carbide brick, installed in the fuel bed zone, eliminate large clinker formations. Their hard, dense faces are impervious to clinker penetration and build-up. The stoker functions more efficiently. Combustion conditions are better. Steaming capacity is increased. Lower maintenance expense is assured by extreme resistance to mechanical wear, flame erosion, spalling and cracking.

MULLFRAX electric furnace mullite brick resist fluid ash attack in the upper walls. Chemical inertness prevents rapid erosion. Channelling of brickwork by slag is prevented. These brick, too, are free from spalling and cracking . . . are not bothered by high temperatures. Should fuel bed depth increase, MULLFRAX brick are sufficiently dense to avert clinker adherence. Accumulations can be removed without damaging the brick.

Furnace linings constructed of this super refractories combination provide more and cheaper steam without repeated replacements. If you burn low fusion ash coals, an investigation will prove profitable. Secure full details by writing Dept. G-77, The Carborundum Company, Refractories Division, Perth Amboy, New Jersey.

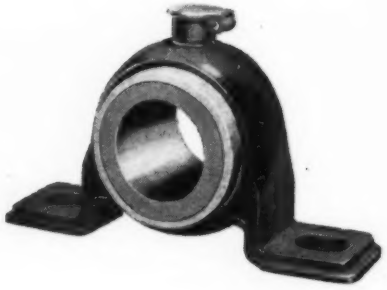
# COMBINATION combats Low Fusion Ash Coals

# SUPER REFRACTORIES

## BY CARBORUNDUM

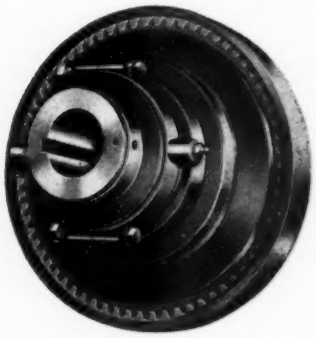
TRADE MARK

*"Carborundum," "Carbofrax" and "Mullfrax" are registered trademarks which indicate manufacture by The Carborundum Company*



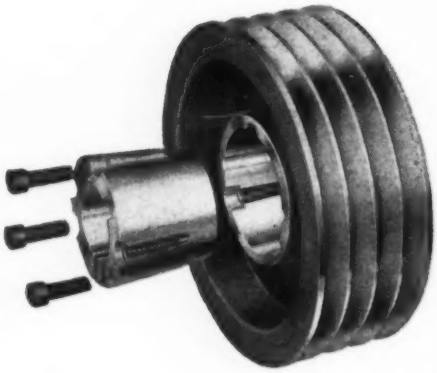
This is the BRONZOIL Bearing. Developed by Dodge for fan and blower service. A new and better transmission appliance.

U. S. Patent No. 1,931,055



This is the ROLLING GRIP Clutch. Developed by Dodge. No toggles. A new and better transmission appliance.

U. S. Patent No. 2,397,414



This is the TAPER-LOCK® Sheave. Developed by Dodge. No flange. No collar. A new and better transmission appliance.

U. S. Patent No. 2,402,743

This is the Dodge Transmissioneer – who will tell you about new ways of transmitting power mechanically.

# DODGE

of Mishawaka, Ind.

New equipment which helps cut costs, improve machine performance, increase production is offered to you by Dodge of Mishawaka. For detailed information about power transmission units to meet specific needs in your plant, or on your product, call the Transmissioneer, your local Dodge distributor. Look for his name in the classified telephone directory under "Power Transmission Equipment." A talk with him will prove profitable to you.

**DODGE MANUFACTURING CORP., MISHAWAKA, IND.**

Copyright, 1947, Dodge Mfg. Corp.

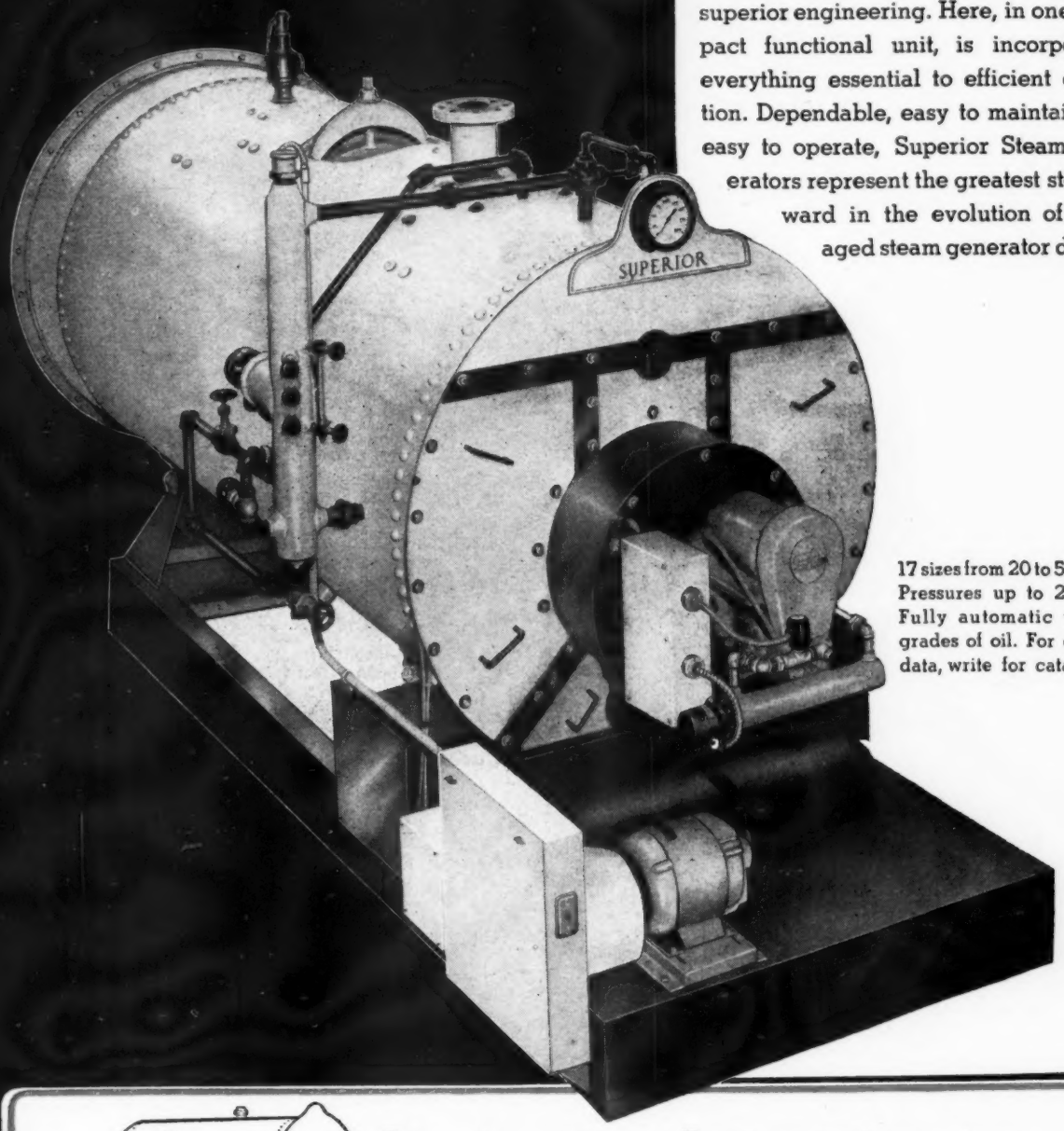
NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

# SUPERIOR

## STEAM GENERATORS

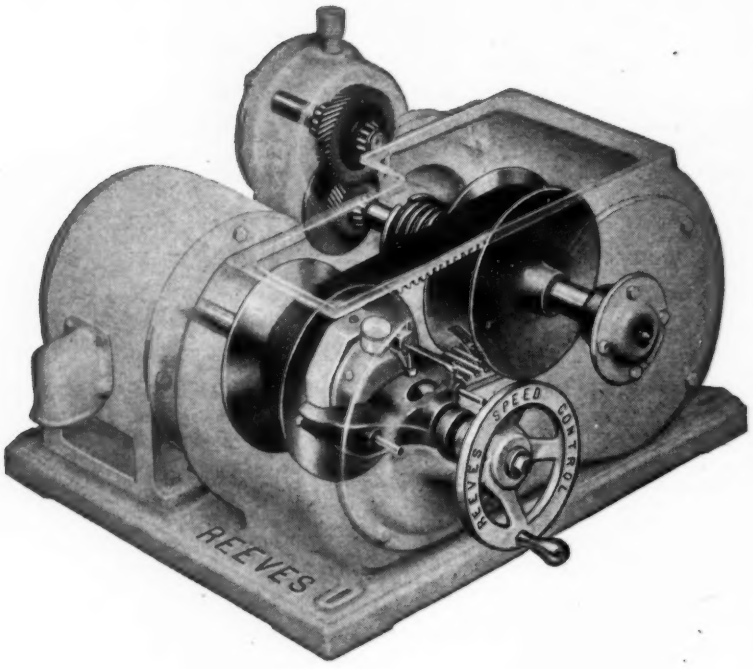
Distinguished by their simplicity, Superior Steam Generators reflect their superior engineering. Here, in one compact functional unit, is incorporated everything essential to efficient operation. Dependable, easy to maintain and easy to operate, Superior Steam Generators represent the greatest step forward in the evolution of packaged steam generator design.




17 sizes from 20 to 500 b.h.p. Pressures up to 200 p.s.i. Fully automatic with all grades of oil. For complete data, write for catalog 101.

Superior Combustion Industries, inc.

*Emmaus, Pa.*




# 260,000 Testimonials Tell the REEVES Story

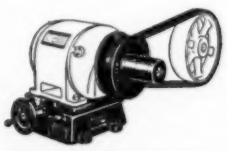
These testimonials aren't letters—but machines! They are doing the intricate jobs, the strange jobs and the familiar jobs on production lines in scores of industries, your own included. They are handling materials of widely varying consistency, weight, hardness and temperature . . . steel, textiles, rubber, foods, plastics, glass, pharmaceuticals and many others. They are stamping, grinding, shaping, turning, winding, spreading, cooling, buffing, conveying and so on . . . some under the direction of skilled, experienced operators and others in the hands of awkward newcomers. But this they have in common: *all* 260,000 of these machines are equipped with REEVES Speed Control . . . *all* are performing each and every operation at exactly the right speed to get the best from man, material and machine . . . *all* are proving, through their day-after-day performance, that REEVES holds the key to improved production—cost-wise and quality-wise!

**REEVES PULLEY COMPANY · COLUMBUS, INDIANA**

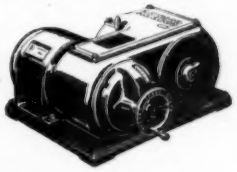
***Recognized Leader in the Specialized Field of Speed Control Engineering***

## THE THREE BASIC REEVES SPEED CONTROL UNITS

**VARIABLE SPEED TRANSMISSION** for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.



**VARI-SPEED MOTOR PULLEY** converts any standard constant speed motor to a variable speed drive within 4:1 ratio. Sizes to 15 hp.



**MOTODRIVE** combines motor, speed varying mechanism and reduction gears in single compact unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 15 hp.

*Accurate Variable*

# REEVES Speed Control

*Gives the Right Speed for Every Job!*

*Dodge-Timken driving assembly consisting of a DV-drive, Dodge-Timken Double Interlock and DH Ironclad Pillow Blocks.*

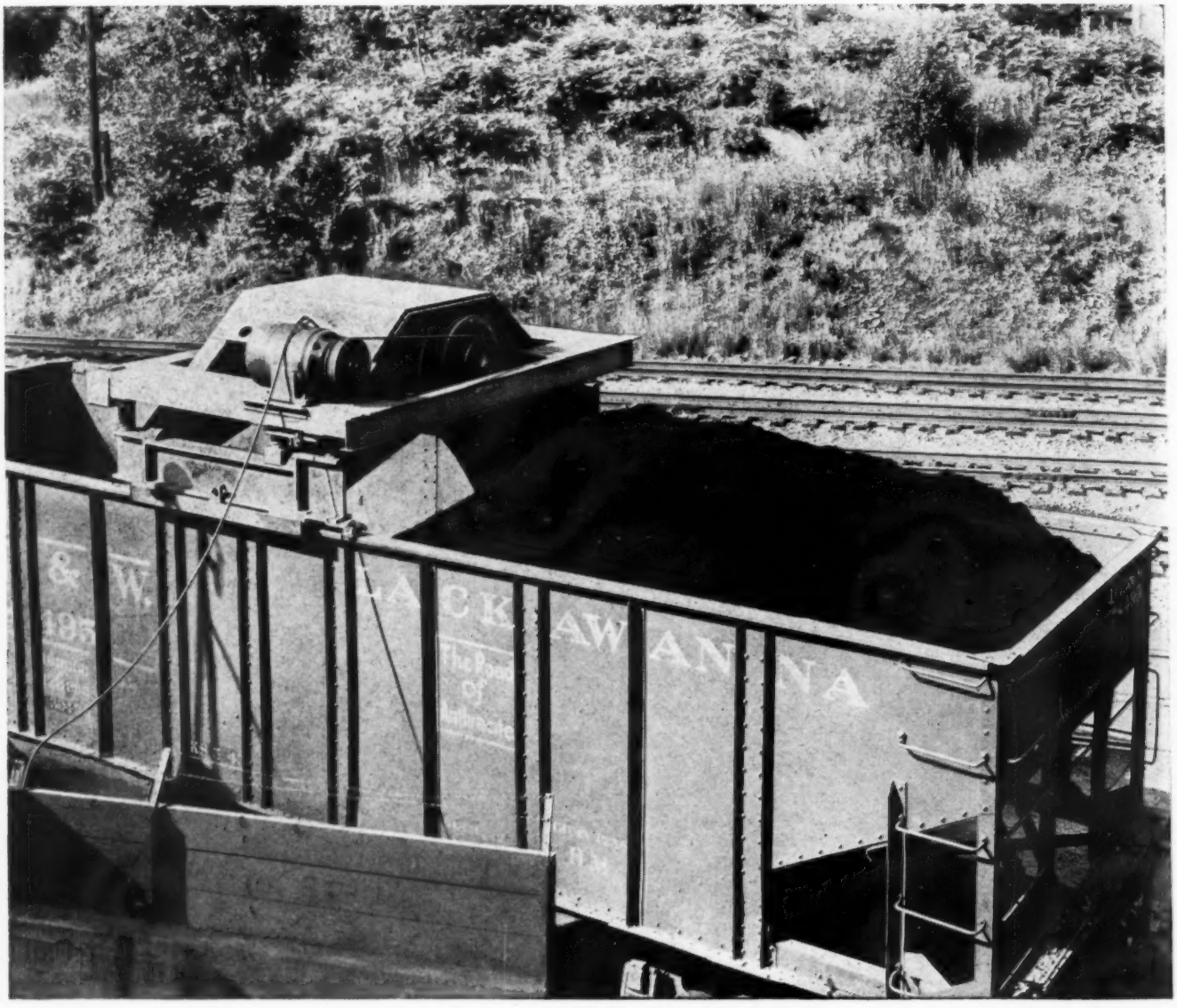
Have you checked up on your power transmission equipment lately? If not it will pay you to do so *now*. Many cases of excessive power cost have been traced to obsolete, friction-ridden pillow blocks and line shaft hangers. They burn up power; wear out shafts; waste lubricant by the barrel, often resulting in product contamination.

**TIMKEN**
TRADE-MARK REG. U. S. PAT. OFF.
**TAPERED ROLLER BEARINGS**

What a contrast when these friction bearing power *pilferers* are replaced with Timken Bearing power *protectors!* You'll enjoy savings all along the line; savings in power, in shafts, in lubricant, in time, in maintenance. Look for the trade-mark "TIMKEN" on every bearing you use.

THE TIMKEN ROLLER BEARING COMPANY, CANTON 6, OHIO

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◫ AND THRUST ◫ LOADS OR ANY COMBINATION ◫



# Great shakes for stubborn coal

That's what users the country over say about the Robins Car Shakeout.

No matter how stubborn coal tries to be, the Robins Car Shakeout shakes it loose . . . unloads the car "broom-clean."

Fifty- or seventy-ton hopper cars are emptied in as little as 90 seconds . . . as much as twelve times faster than manual unloading!

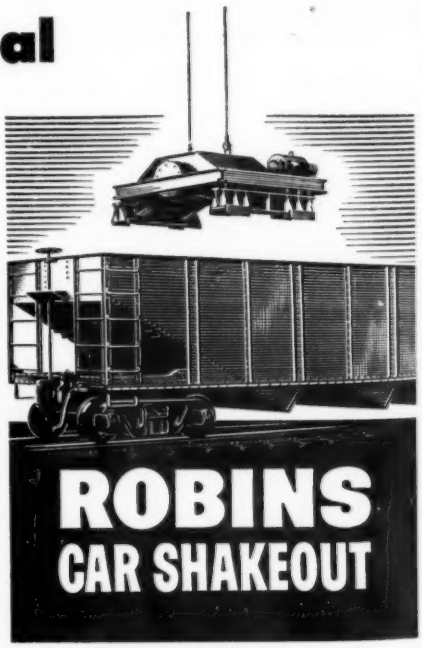
And it's simple to operate. Just lower it onto the car. Press a button. And the Shakeout does the rest. It loosens coal even when it's tightly packed or frozen . . . lets it flow freely and quickly through the hopper doors of the car.

Contrast this with the old-fashioned and costly manual method of car-unloading which often required as many as six men to empty one car.

**Quick, efficient unloading with the Robins Car Shakeout will enable you to get coal cars off your siding in a hurry . . . will help eliminate demurrage charges.**

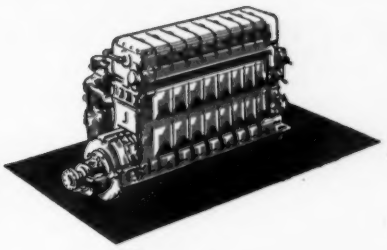
Actual field operations by scores of users prove that this new, portable unit does a thorough job with complete safety to the operator . . . with no damage to the cars.

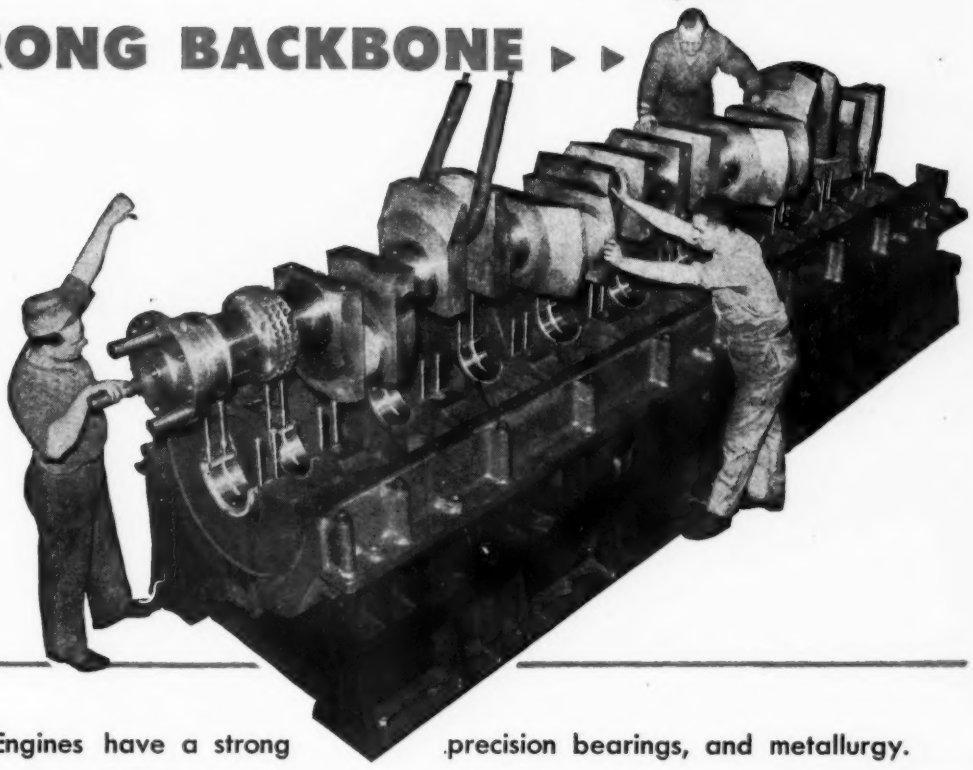
Write for this new booklet about the Robins Car Shakeout. It tells you how to save time, money and manpower.




**ROBINS CONVEYORS DIVISION,** Hewitt-Robins Incorporated, Passaic, N. J.

# EVERY SUPERIOR DIESEL ENGINE HAS A STRONG BACKBONE ▸▸





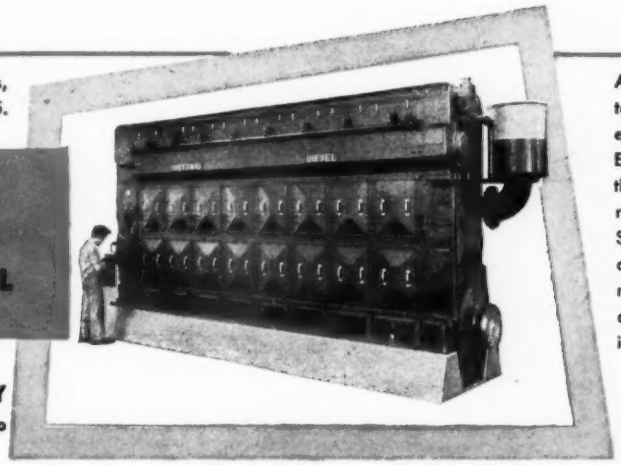
SUPERIOR Diesel Engines have a strong backbone . . . big crankshafts; sturdy bases to support them and high tensile strength alloy castings throughout. Superior's nearly 60 years of engine building experience and research have resulted in a strong, tough engine with plenty of stamina. Ways and means are constantly sought to take advantage of the latest developments in lubrication, efficient fuel consumption, precision bearings, and metallurgy.

Proof of the dependability and economy of Superior Diesel Engines lies in the constantly increasing demand for them. A demand so great, that $1,500,000 is being spent on plant expansion to take care of present and future needs. One of our sales representatives will be glad to show you how a Superior Diesel Engine will fit into your profit-building plans.

For complete details of Superior Stationary Diesels, write today for your free copy of Bulletin 4705.

Superior DIESEL

**SUPERIOR ENGINES DIVISION OF**
**THE NATIONAL SUPPLY COMPANY**
**Plant and General Sales Office: Springfield, Ohio**



As a result of the satisfactory performance provided by a Superior Diesel Engine installed in 1937, the city of Sandersville, Ga., recently added another Superior to provide additional power for their municipal light plant. It's a model 80-S-8 developing 1440 HP at 360 rpm.

You Can See for Yourself . . .

# WHY the Foster 38-SV Safety Valve is ESPECIALLY SUITABLE FOR

# HIGH PRESSURES HIGH TEMPERATURES

Pressures up to 3000 pounds and temperatures of 1200° F. are easily handled by the Foster Type 38-SV Super-Jet Safety Valve—it was designed especially for just these exacting requirements! It's no mere "beefed-up" low-pressure valve—rather it's a basic new design for high-pressure service.

Only the Foster 38-SV Safety Valve gives you all these advantages:

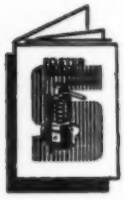
1 . . . ***Exceptional steam economy*** because . . . it reseats as low as 1% below popping pressure . . . reseating is positive; without pounding or chatter . . . blowdown is adjustable from 8% down to 1%.

2 . . . ***Unaffected by temperature changes*** because . . . frame rod construction makes crawl negligible . . . deflector protects spring and rods from escaping steam.

3 . . . ***Maximum protection*** because . . . full opening is practically instantaneous . . . full rated nozzle capacity is available at popping pressure . . . once set under operating conditions, its popping point is constant.

4 . . . ***Positive reseating*** because . . . floating disc design . . . steam-centered piston . . . permanently flat seats.

Specify the Foster 38-SV Super-Jet Safety Valve for the finest in high-pressure protection!

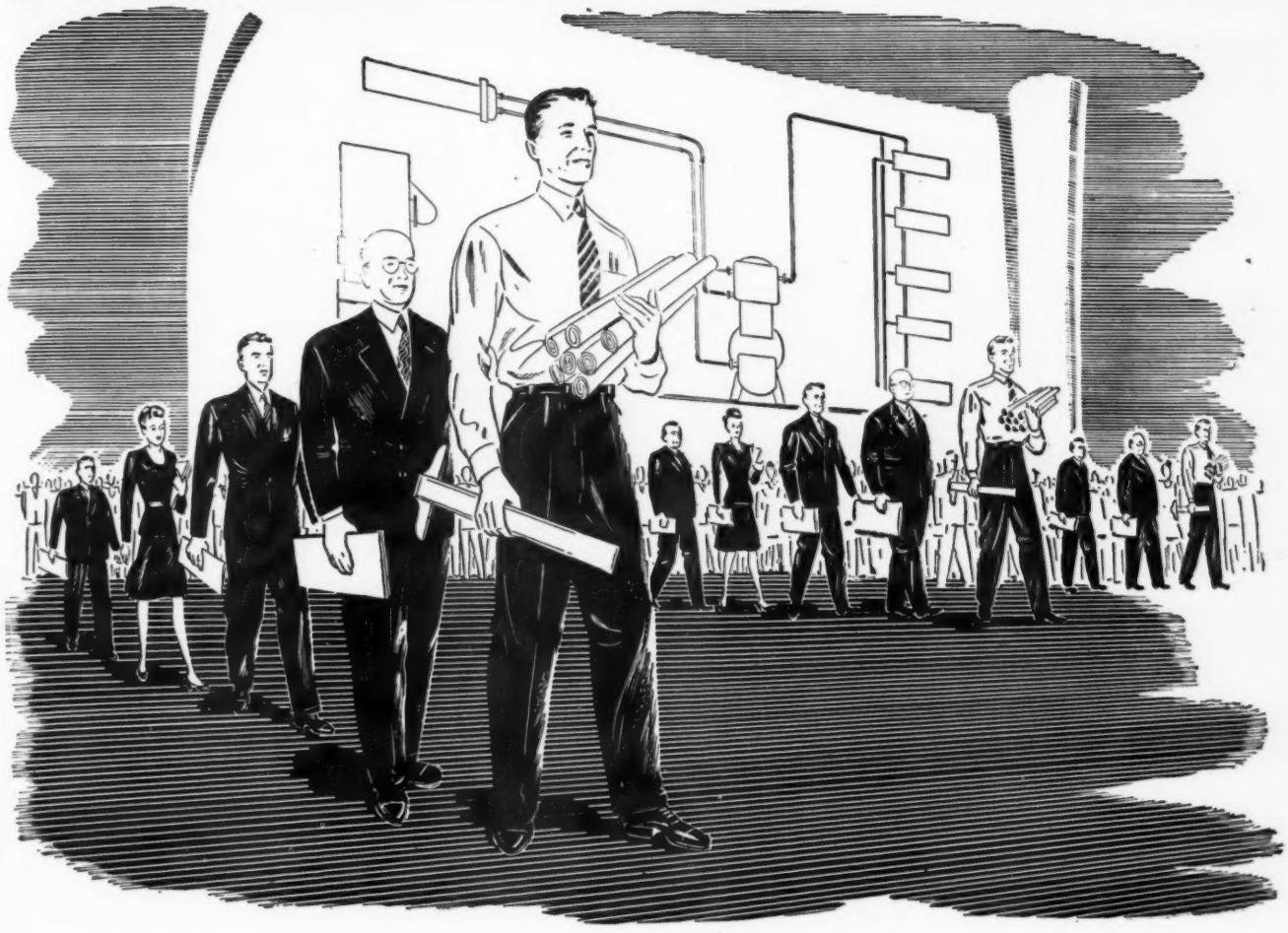


Complete details of the Foster 38-SV Super-Jet Safety Valve, for pressures up to 3000 pounds and temperatures up to 1200° F., are given in Bulletin 25. Write for it today!

# FOSTER ENGINEERING Company

PRESSURE REGULATORS . . . RELIEF AND BACK PRESSURE VALVES . . . AUTOMATIC STOP AND CHECK VALVES . . . ALTITUDE VALVES . . . DAMPER REGULATORS . . . FAN ENGINE REGULATORS . . . PUMP GOVERNORS . . . TEMPERATURE REGULATORS . . . LIQUID LEVEL CONTROLLERS . . . FLOAT AND LEVER BALANCED VALVES . . . NON-RETURN AND TRIPLE DUTY VALVES . . . VACUUM REGULATORS OR BREAKERS . . . SIGHT FLOW BOXES . . . STRAINERS . . . SAFETY VALVES . . . SIRENS

106 MONROE STREET • NEWARK 1, N. J.



# IN THE HOUSE OF WEATHER MAGIC . . . ONE OUT OF FIVE IS AN ENGINEER

*One out of every five of the people in the main office of the Trane Company is an engineer.* Considering the number of people required for the duties of accounting, order handling, and the like, the figure is significant. Small wonder that Trane has been called an organization of manufacturing engineers.

Engineering governs every phase of Trane activity . . . from the design, testing, and manufacture of Trane products to cooperation with architects, engineers, and contractors by Trane field engineers. Thus is the phrase Engineered Air Conditioning given meaning in the fullest sense.

Trane heating systems and air conditioning systems are designed by the architect, engineer, or contractor, drawing on the *complete* line of Trane products. Trane field offices in 85 principal cities offer these men their entire cooperation.

* * *

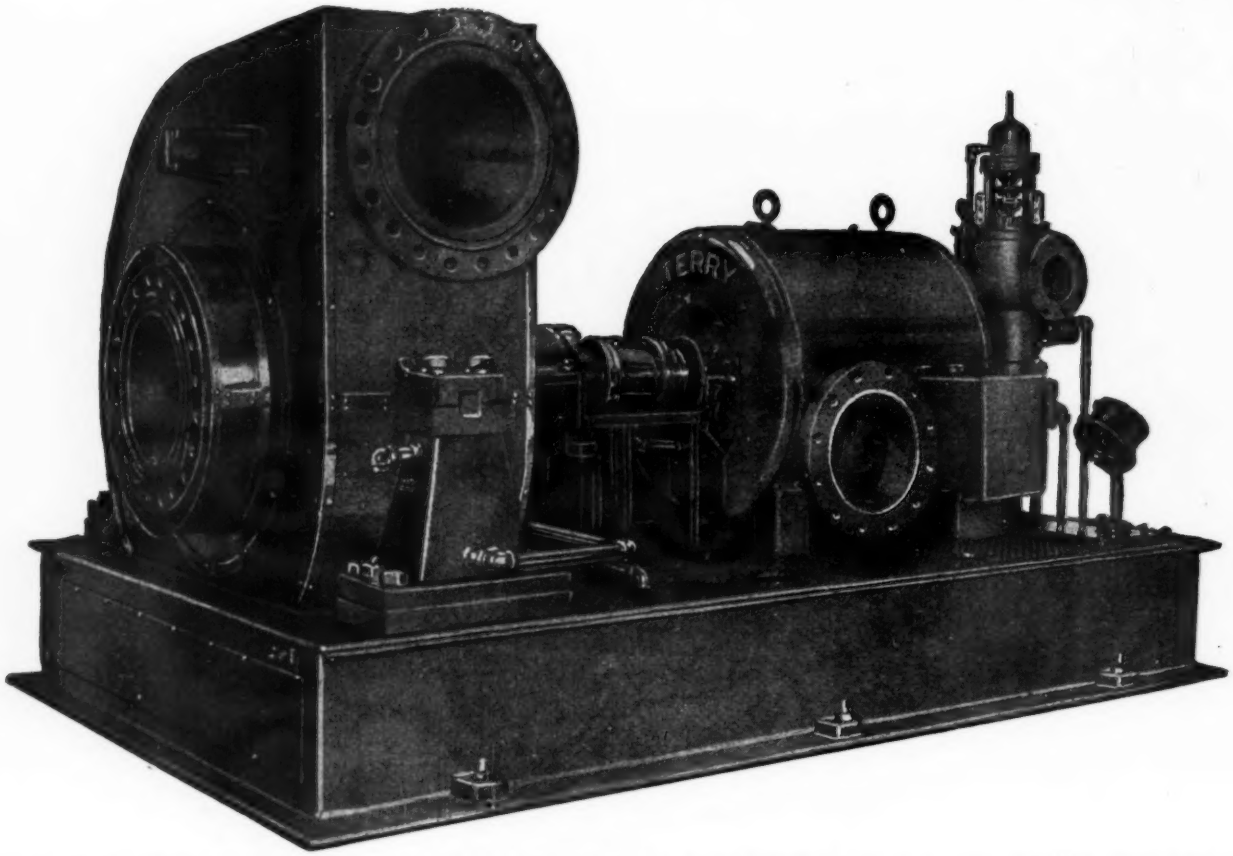
*The Convector-radiator—modern successor to the old-fashioned cast iron radiator—has been engineered by Trane for universal application to steam and hot water heating systems, and is being produced in quantity so you can soon secure it from local distributors' stocks.*

**TRANE**

Manufacturing Engineers of Equipment for
HEATING AND AIR CONDITIONING

THE TRANE COMPANY, LA CROSSE, WISCONSIN • Also TRANE COMPANY OF CANADA, LTD., TORONTO, ONTARIO

# *The* TERRY TURBINE




## MULTI-STAGED TURBINES CAREFULLY ENGINEERED TO MEET YOUR REQUIREMENTS

Each Terry Multi-staged Turbine is individually designed and proportioned in accordance with the plant conditions and requirements.

A typical unit is shown above direct connected to a blower. This turbine is rated 1200 H.P. at 6100 R.P.M. It is equipped with six stages and operates condensing. The governor is of the oil relay variable speed type. The lubrication system provides flood lubrication to the turbine and blower bearings.

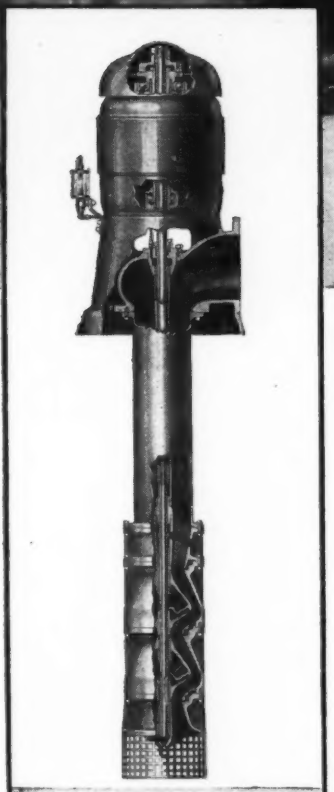
If you have an application for a turbine — single staged or multi-staged — geared or direct connected — standard or special — in sizes up to 2000 H.P. — talk it over with Terry.

T 1162

**THE TERRY STEAM TURBINE COMPANY**
**TERRY SQUARE, HARTFORD, CONN.**

# SAVE *Installation and Maintenance Costs...*

*Cooling Tower Water Service Installation with PACIFIC Type CT Vertical Pumps driven by electric motors—Courtesy Phillips Petroleum Company.*



*Cut Away View PACIFIC Type CT Vertical Pump. Single or Multi-Stage for All Heads. Capacities 1000 to 25,000 G.P.M.*

## *with* PACIFIC TYPE CT VERTICAL PUMPS

- PACIFIC **CT PUMPS ARE COMPACT**—require *one-third* floor space of horizontal pumps of equal capacity.
- PACIFIC **CT PUMPS ARE EASY TO INSTALL**—do not require expensive foundations or dry pits with sump pumps for drainage.
- PACIFIC **CT PUMPS ARE ALWAYS SUBMERGED**—no priming devices to install and maintain.
- PACIFIC **CT PUMPS ARE ECONOMICAL TO OPERATE**—dynamically balanced impellers prevent destructive vibration. Moderate rotative speeds insure minimum wear—maximum life with sustained efficiency and low maintenance cost.

**PACIFIC** *Precision Built* **PUMPS**

**PACIFIC PUMPS, INC.**
HUNTINGTON PARK, CALIFORNIA

*One of the Dresser Industries*

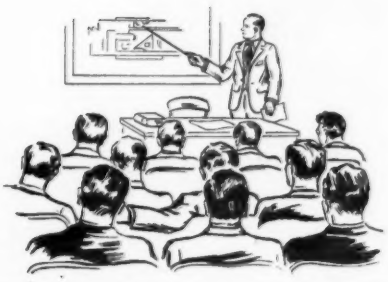
Offices in All Principal Cities—Export Office: 122 E. 42nd Street, New York City

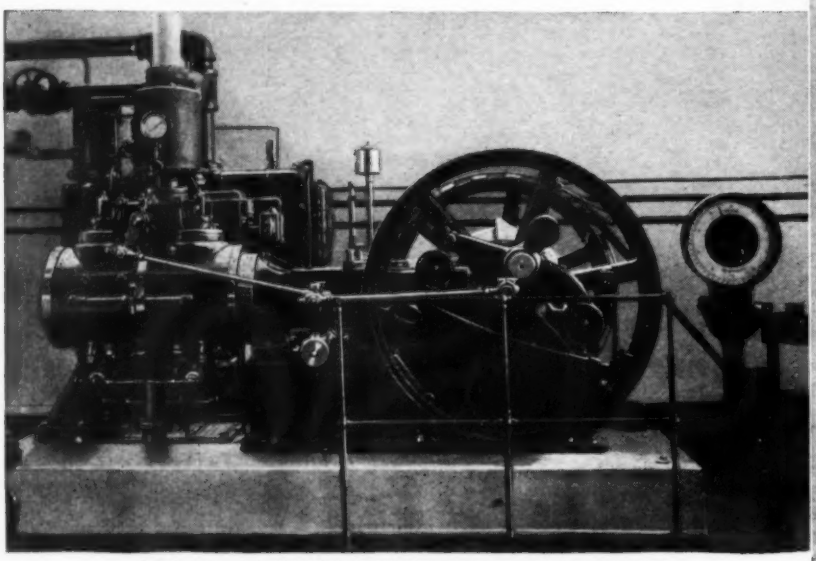
# *Leading Engineering Schools Select*

# SKINNER

## "Universal Unaflow" Steam Engines

## *For Laboratory Study and Testing*





75-Horsepower "UNIVERSAL UNAFLOW" with Testing Apparatus Installed in Mason Laboratory, Sheffield Scientific School, Yale University.

A steam engine for laboratory study must meet definite requirements. It must, first of all, be correct in latest scientific design. To clearly illustrate fundamental principles, it must be free from unnecessary complications. It must be rugged and tough, to stand testing under normal and abnormal conditions. It must, in short, have everything that a commercial installation requires, and have it to an exceptional degree.

We feel it a high compliment that so many of the leading authorities in the engineering field have selected the Skinner "Universal Unaflow" as a model for study and illustration. The engines are not special laboratory models in any respect, except for their smaller size, and embody every important feature of our largest installations.

In addition to these laboratory test engines, many colleges and schools, from coast to coast, are using Skinner "Universal Unaflow" Steam Engines for the generation of electric power; adding to the testimony of institutional and industrial users everywhere, that the "Skinner 'Universal Unaflow' is the most economical steam engine built."

Write us for details on experienced economies with Skinner installations for generating electric power or driving pumps, compressors, blowers, lineshafts and other loads in your own field.

**Laboratory Test Installations**

1—YALE UNIVERSITY
New Haven, Conn.
(Sheffield Scientific School, Mason Lab.)
1—MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Cambridge, Mass.
1—UNIVERSITY OF WISCONSIN
Madison 6, Wisconsin
1—U. S. MILITARY ACADEMY
West Point, N.Y.
1—UNIVERSITY OF NOTRE DAME
Notre Dame, Ind.
1—ENGINEERING EXPERIMENT STATION
Annapolis, Md.
1—UNIVERSITY OF CONNECTICUT
Storrs, Conn.
1—UNIVERSITY OF LOUISVILLE
Louisville, Ky.
1—UNIVERSITY OF UTAH
Salt Lake City, Utah
1—UNIVERSITY OF KANSAS
Lawrence, Kansas
1—SOUTHWESTERN LOUISIANA INSTITUTE
Lafayette, La.
1—OKLAHOMA AGRICULTURAL & MECHANICAL COLLEGE
Stillwater, Okla.
1—STATE COLLEGE OF WASHINGTON
Pullman, Washington
1—VANDERBILT UNIVERSITY
Nashville, Tennessee

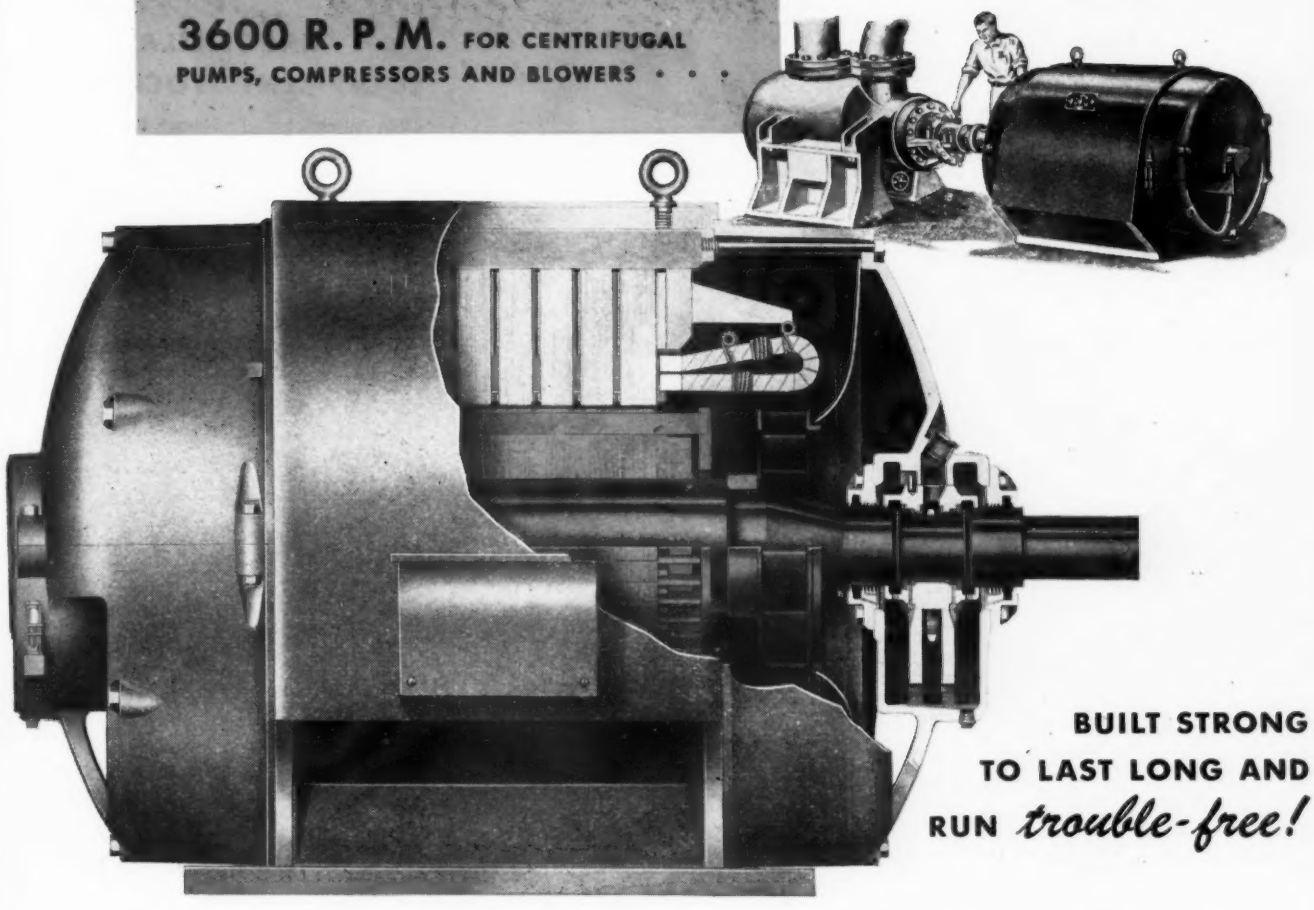
**Power Plant Installations**

3—CULVER MILITARY ACADEMY
Culver, Ind.
2—YALE UNIVERSITY
Sterling Hall of Medicine
New Haven, Conn.
1—SWARTHMORE COLLEGE
Swarthmore, Pa.
1—UNIVERSITY OF WEST VIRGINIA
Morgantown, W. Va.
1—UNIVERSITY OF SOUTH DAKOTA
Vermillion, S.D.
1—UNIVERSITY OF MISSISSIPPI
University, Miss.
2—PEDDIE INSTITUTE
Hightstown, N.J.
1—APPALACHIAN STATE TEACHERS' COLLEGE
Boone, N.C.
1—ARKANSAS POLYTECHNIC COLLEGE
Russellville, Ark.
2—BIBLE INSTITUTE
Los Angeles, Calif.
2—CONCORDIA SEMINARY
St. Louis, Mo.
1—DREXEL INSTITUTE
Philadelphia, Pa.
1—CENTRAL HIGH SCHOOL
Evansville, Ind.
2—HADLEY VOCATIONAL HIGH SCHOOL
St. Louis, Mo.
1—ARSENAL TECHNICAL SCHOOLS
Indianapolis, Ind.
1—MIAMI UNIVERSITY
Oxford, Ohio
2—MISSISSIPPI STATE COLLEGE
Starkville, Miss.
1—NEWTON HIGH SCHOOL
Newton, Mass.
1—THE SCHOOL OF THE OZARKS
Hollister, Mo.
1—PENNSYLVANIA STATE TEACHERS' COLLEGE
Indiana, Pa.
1—PENNSYLVANIA STATE TEACHERS' COLLEGE
Slippery Rock, Pa.
2—COLLEGE OF ST. CATHERINE
St. Paul, Minn.
1—WALLA WALLA COLLEGE
College Place, Wash.
2—WESTOVER SCHOOL
Middlebury, Conn.

*For Over 75 Years, Doing One Thing Well—Building Steam Engines*

**SKINNER ENGINE COMPANY, ERIE, PA.**

**3600 R.P.M.** FOR CENTRIFUGAL PUMPS, COMPRESSORS AND BLOWERS • • •



**BUILT STRONG TO LAST LONG AND RUN *trouble-free!***

# E-M's NEW HEAVY-DUTY SQUIRREL-CAGE INDUCTION MOTOR

Large boiler feed pumps and oil pipeline pumps demand the highest degree of continuous reliable performance from their motor drives. The exacting requirements of high-speed service are met in the NEW, modern E-M Heavy-Duty Two-Pole Squirrel-Cage Induction Motor. Incorporating all the important advances in modern motor design and construction such as listed at the right, this new E-M motor provides extra features for dependability in continuous service. Heavy-duty construction forestalls breakdown. Protective design encourages preventive maintenance. Selection of this E-M motor assures years of trouble-free performance for high-speed pumps, compressors and blowers.

*Send the coupon for descriptive literature.*

**DRIP-PROOF**—Protective construction guards against falling liquids and particles. Streamlined exterior is easy to keep clean.

**STEEL FRAME**—Strong without excessive weight. Steel bar feet that cannot crack.

**EXTRA TOUGH COILS**—Form-wound, multi-layer insulation, varnish impregnated, moisture resistant, firmly braced coil-ends.

**MINIMUM NOISE**—Magnetic circuit designed for quiet operation. Windage noise minimized. Double-end specially engineered ventilation moves abundant air at low velocity.

**PHOS-COPPER BRAZE-WELDED CAGE WINDING**—designed to keep expansion and contraction within elastic limits of cage bars and end-rings.

**LEAK-PROOF, DUST-PROOF BEARINGS**—Ground journals, cool running, easily accessible. Kolene-Process, centrifugally-cast sleeves insure uniform babbitt free from blow-holes.

**STRONG, STIFF ROTOR**—Core punchings stocked on shaft and held between welded pressure plates; extra-large diameter, carbon steel shaft has first critical speed well above running speed.

E-M

**ELECTRIC MACHINERY MFG. COMPANY • MINNEAPOLIS 13, MINNESOTA**

Please send me your six page colored booklet, "E-M Two-Pole Heavy-Duty Squirrel-Cage Induction Motors" and foldout sheet detailing construction.

Name_____

Firm_____ Address_____

City_____ Zone_____ State_____

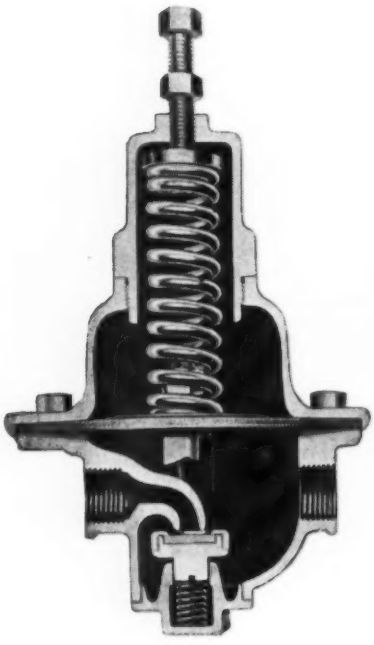
A 2047

# IT'S THE RULE

## instead of the exception...

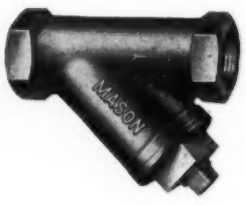
# MASONEILAN REGULATORS

## Reduce Costs with Long-Lived Performance!



**No. 414 for Air Service.** Other Masoneilan Pressure Reducing Regulators are available for water, steam and air.

You can count on Masoneilan Regulators to save you money because they accurately control pressure, reduce waste and minimize time-out of service. In addition, such advantages as ease of adjustment, rugged construction and low maintenance assure reduced costs.




**MASONEILAN STRAINERS**

Use these strainers to prevent scale, dirt, chips, etc., from damaging regulators, traps, valves and pumps. These strainers keep out all foreign matter. They eliminate maintenance delays and thus save money.

## MASONEILAN EQUIPMENT STOCKED BY:

**Allen & Reed, Inc.**, Providence, R. I.
**Appleby Bros. & Whittaker**, Harrisburg, Penna.
**Atlantic Pipe & Supply Co.**, Boston, Mass.
**Babbitt Steam Specialty Co.**, New Bedford, Mass.
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**Barrett-Christie Co.**, Chicago, Ill.
**Berkshire Mill Supply**, Pittsfield, Mass.
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**Boston Pipe & Fittings Co.**, Cambridge, Mass.
**Braman Dow & Co.**, Boston, Mass.
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**Dixie Mill Supply Co.**, New Orleans, La.
**Morton McI. Dukehart**, Baltimore, Md.
**Evansville Supply Co.**, Evansville, Ind.
**Fall River Steam & Gas Pipe Co. Corp.**, Fall River, Mass.
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**Fuchs Machinery & Supply Co.**, Omaha, Nebr.
**Galloup Pipe & Supply Co.**, Battle Creek, Mich.
**Galloup Pipe & Supply Co.**, Jackson, Michigan
**Galloup Pipe & Supply Co.**, Kalamazoo, Mich.
**Grinnell Co., Inc.**, Cleveland, Ohio
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MASONEILAN

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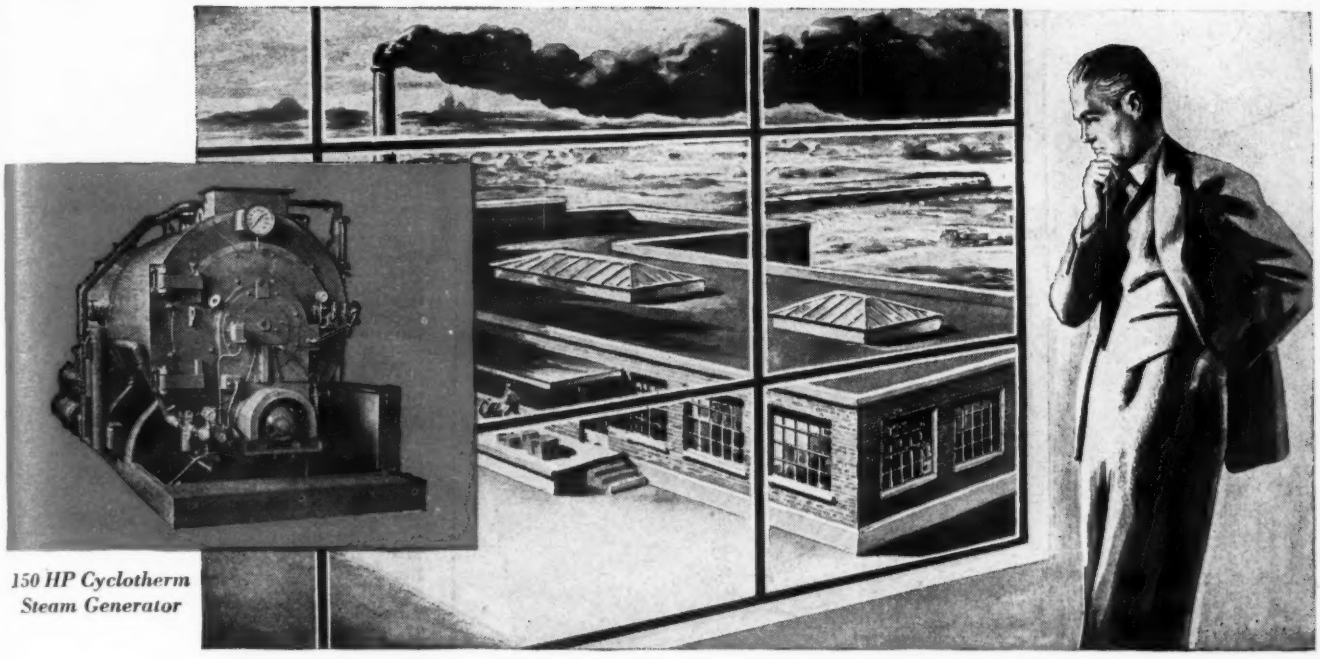
Mason Regulator Co. of Canada, Ltd.
Montreal and Toronto



*150 HP Cyclotherm Steam Generator*

# Are you Beating Competition in cost of steam—*if not*

# WRITE CYCLOTHERM

Flexibility in operating a single Cyclotherm, or a battery of several, meets all demands for maximum or minimum production of steam economically without impairment of operating efficiency.

The automatic modulating steam pressure control system of a Cyclotherm Steam Generator provides the proper quantitive fuel-air relationship for all firing rates, but with oil (or gas) and air pressures constant.

Such soundly economical efficiency accounts for the steadily increasing purchases of Cyclotherms by both large and small producers of steam for processing, power and heating. These customers did not buy Cyclotherms with their eyes shut. They knew that the efficient production of steam is a profit-building factor in all competitive business fields.

If you have a problem based on reducing operating or maintenance costs in steam production, write or telephone us. Your inquiry will receive our immediate attention.

POWER

PROCESSING

HEATING

**CYCLOTHERM STEAM GENERATORS**

CYCLOTHERM CORPORATION, 90 BROAD STREET, BOX 102 Z, NEW YORK 4, N. Y.

# OTIS

# POW-R-TRUCK

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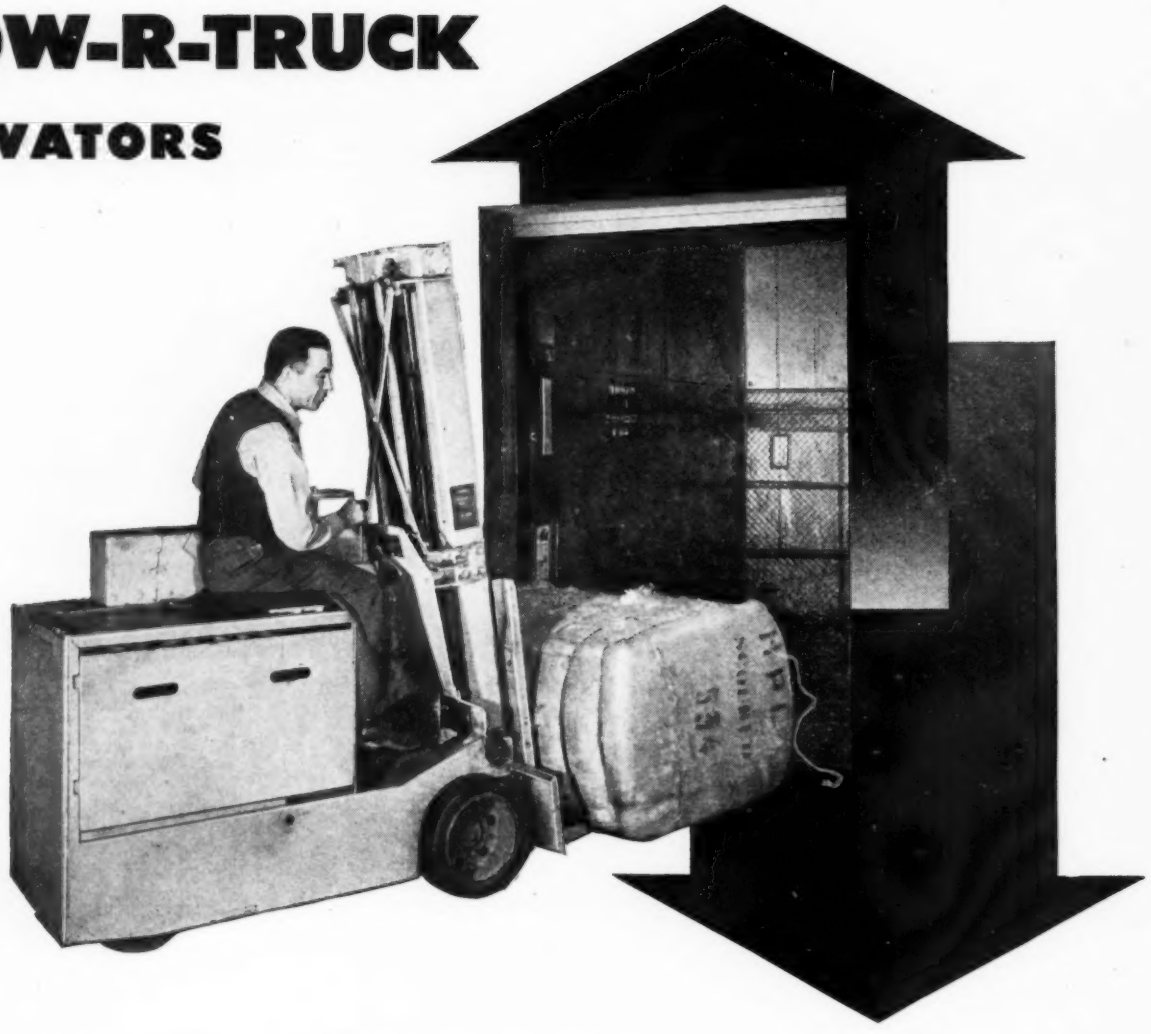


### ADD THE "THIRD DIMENSION" TO POWER TRUCK TRANSPORTATION

Otis **POW-R-TRUCK** elevators add *up-and-down* travel to the many other advantages of power truck-loading!

With a **POW-R-TRUCK** elevator, industrial trucks become completely mobile units—free to go to upper or lower floors – free to take loads directly to destination. With a **POW-R-TRUCK** elevator you lose no time in loading, picking up or re-handling.

**POW-R-TRUCK** elevators are the world's only standard line of elevators built to:

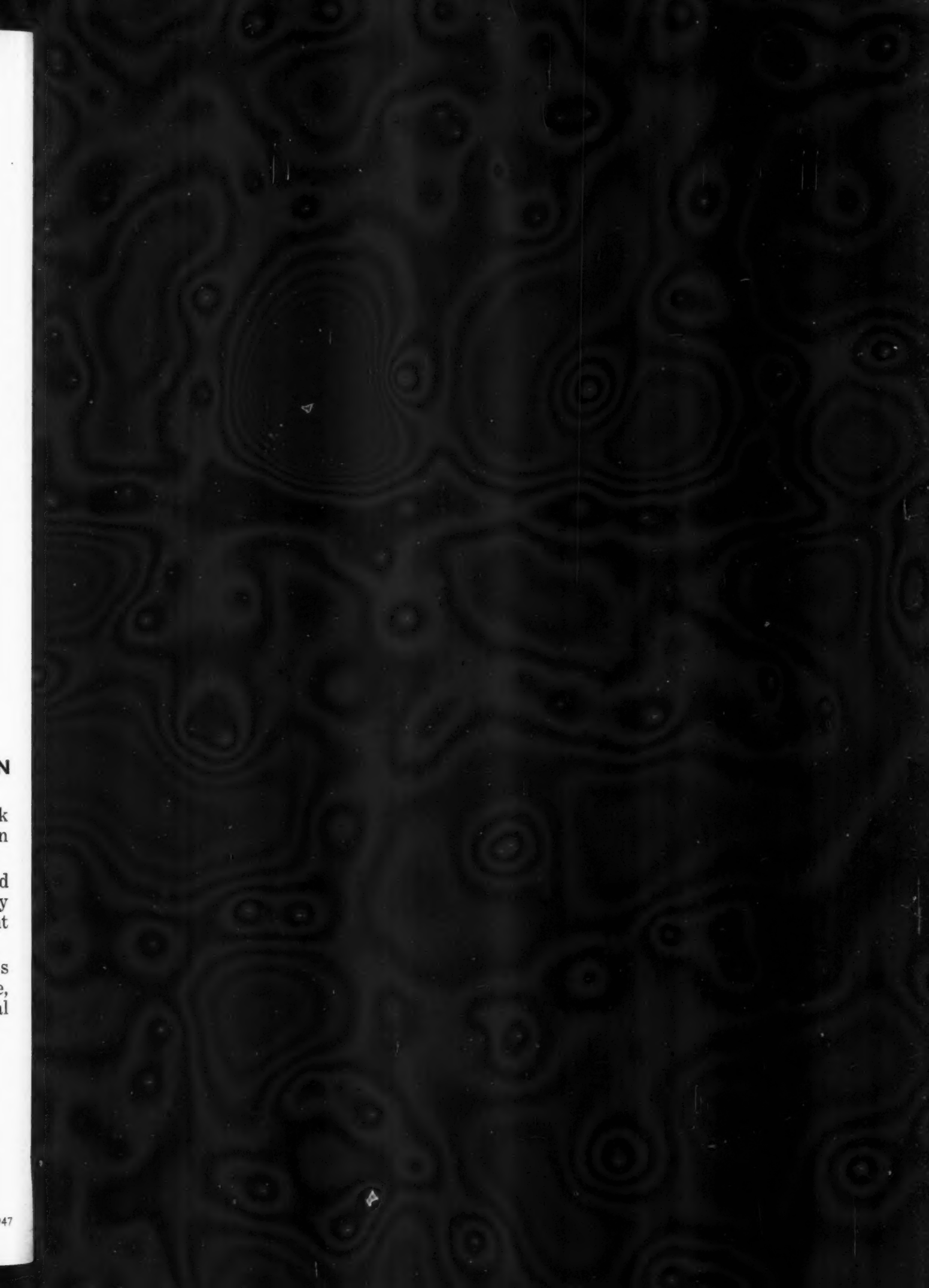
1. Withstand severest off-balance loading and impact loading.
2. Carry both truck and pay-load safely and swiftly.
3. Suit every size, speed and capacity need.

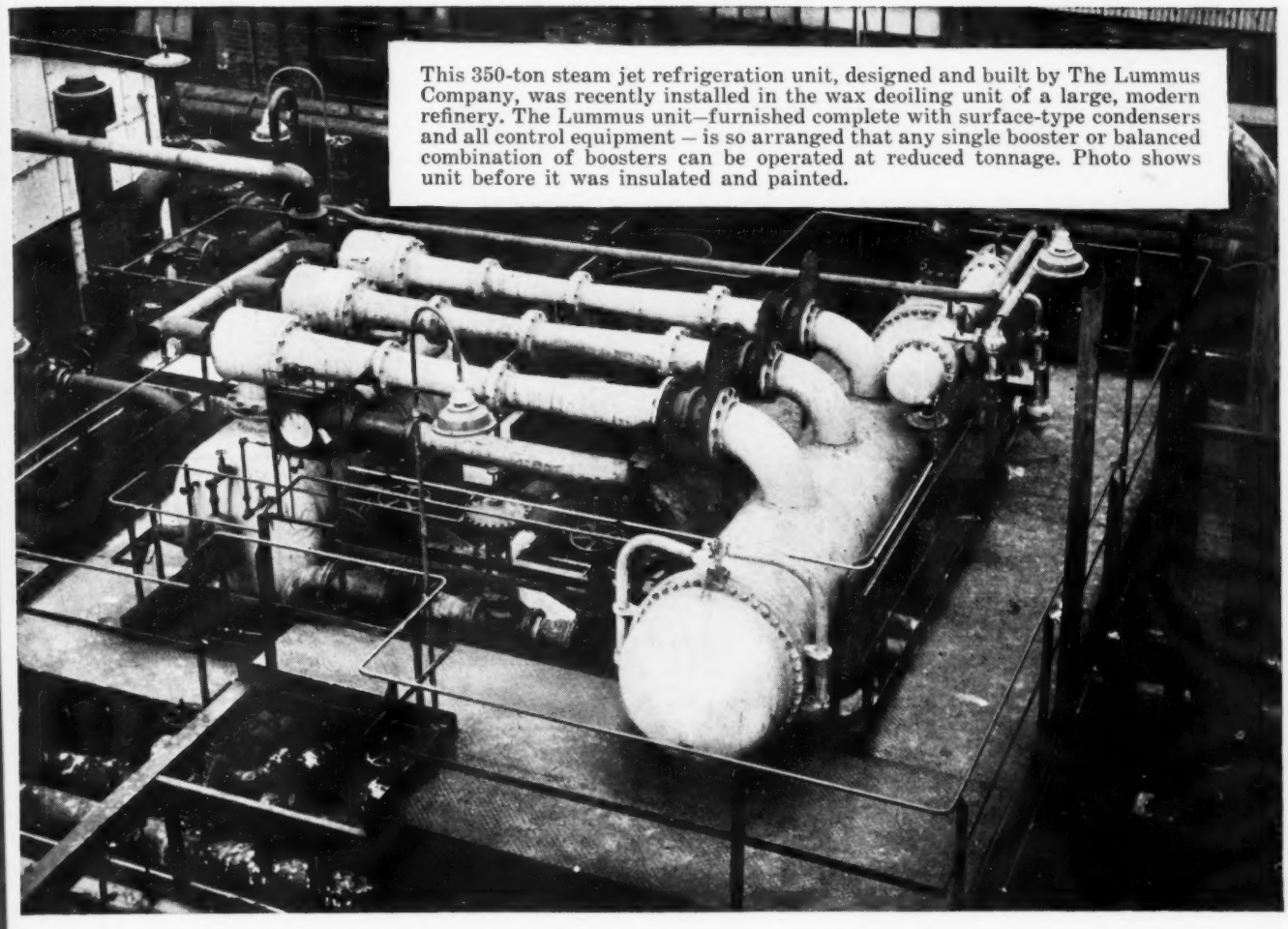
You get *all* the advantages of power truck and unit-loading, when your trucks can travel vertically as well as horizontally.

**POW-R-TRUCK** elevators, standardized and made exclusively by Otis, are only slightly higher in cost than conventional freight elevators.

For illustrated folder please write Otis Elevator Company, 260 Eleventh Avenue, New York 1, New York, or call your local Otis office.

Otis ELEVATOR COMPANY
OFFICES IN ALL PRINCIPAL CITIES





This 350-ton steam jet refrigeration unit, designed and built by The Lummus Company, was recently installed in the wax deoiling unit of a large, modern refinery. The Lummus unit—furnished complete with surface-type condensers and all control equipment – is so arranged that any single booster or balanced combination of boosters can be operated at reduced tonnage. Photo shows unit before it was insulated and painted.

# *If your process requires chilled water ---*

***you'll benefit five ways with a Lummus steam jet refrigeration unit*** — You have a right to expect any steam jet refrigeration unit to *operate efficiently*. In addition, Lummus' broad experience in steam jet refrigeration assures five other basic benefits:

*simple operation*
*long service life*
*low operating cost*
*low maintenance cost*
*no expensive refrigerant replacement*

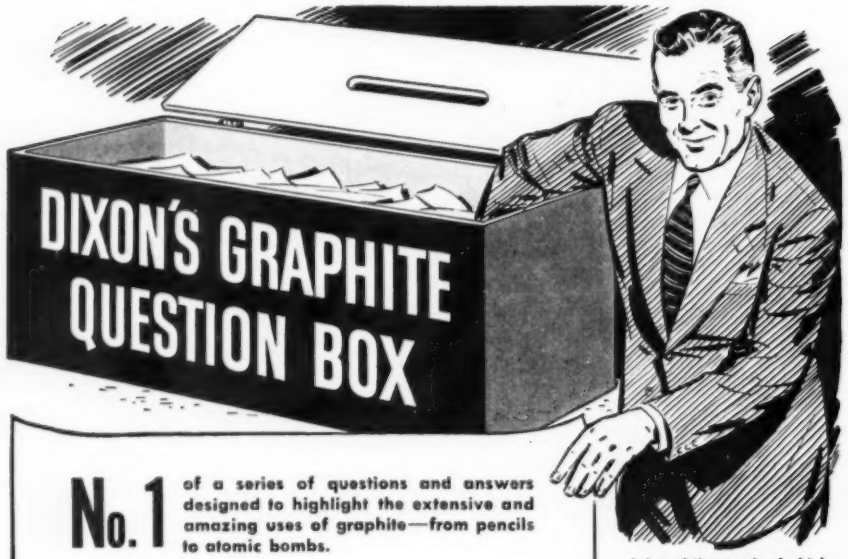
Lummus steam jet refrigeration units operate with minimum quantities of steam and condensing water. They can be designed to operate on either exhaust or live steam and with all sources of cooling water. Cooling rate can be controlled automatically or manually.

For petroleum, chemical, and other industrial processes requiring chilled water, Lummus designs and fabricates both surface- and barometric-condenser type units for all ranges of operating temperatures. Standardized units are available for a wide range of requirements. Lummus engineers can help solve special steam jet refrigeration problems.

For further information, call or write *Heat Exchanger Division, The Lummus Company, 420 Lexington Avenue, New York 17, N. Y.*

**Lummus** ***STEAM JET REFRIGERATION***

**Look to Lummus for:** Heat Exchangers • Process Condensers • Reboilers • Steam Generators • Steam Jet Refrigeration • Steam Surface Condensers • Barometric Condensers • Steam Jet Air Ejectors • Evaporators • Boiler Blowdown Heat Exchangers • Fuel Oil Heaters • Lubricating Oil Coolers • Pipe Line Coolers • Feed Water Heaters • Jacket Water Coolers




**No. 1** of a series of questions and answers designed to highlight the extensive and amazing uses of graphite—from pencils to atomic bombs.

## SOURCE AND PROPERTIES OF GRAPHITE

**QUES.** What is graphite?

**ANS.** One of the softest minerals of the carbon family—believed to be an end product of natural processes involving heat, pressure and time—extremely lubricous or slippery, non-metallic, non-magnetic, non-toxic and non-odorous.

**QUES.** Where are the principal commercial sources of graphite?

**ANS.** Madagascar, Ceylon, Mexico and Korea. Some are found in the United States.

**QUES.** Is there more than one type of graphite?

**ANS.** Yes. The natural crystalline type is found in laminations of very thin flakes and in vein-like strata of fibrous structure. The natural amorphous type is of rather earthy structure.

**QUES.** Which type of graphite is obtainable in the highest purities?

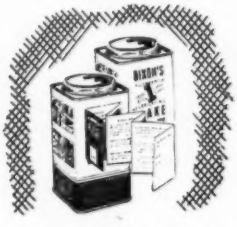
**ANS.** The crystalline varieties, after refinement, run highest in graphitic carbon.

**QUES.** In what average particle sizes are processed graphites available?

**ANS.** Over an extremely wide graduated range from an average of 2 microns to large flake sizes containing particles from 1/5 to 2 millimeters.

More on *"Source and Properties of Graphite"* in next ad.

A few of thousands of widely used products containing Dixon's Graphites. Those starred are Dixon products, many of them sold by supply houses everywhere.




★Ticonderoga Flake Graphites No. 1 & No. 2

★Cup Grease No. 3

★Lubricating and Penetrating Oil

Now may we receive *your questions* on how graphite can help *you*?

# DIXON'S GRAPHITES

Products of
JOSEPH DIXON CRUCIBLE COMPANY
Jersey City 3, N. J. Div. 94-Q-7

**LOOK FOR No. 2**
*in this series. We will gladly send you reprints of any you may miss*

# "THAT'S FOR ME!!!"

That's just exactly what the man said.

You've probably said it, too — as you leafed through the advertising pages of a current issue of THIS magazine.

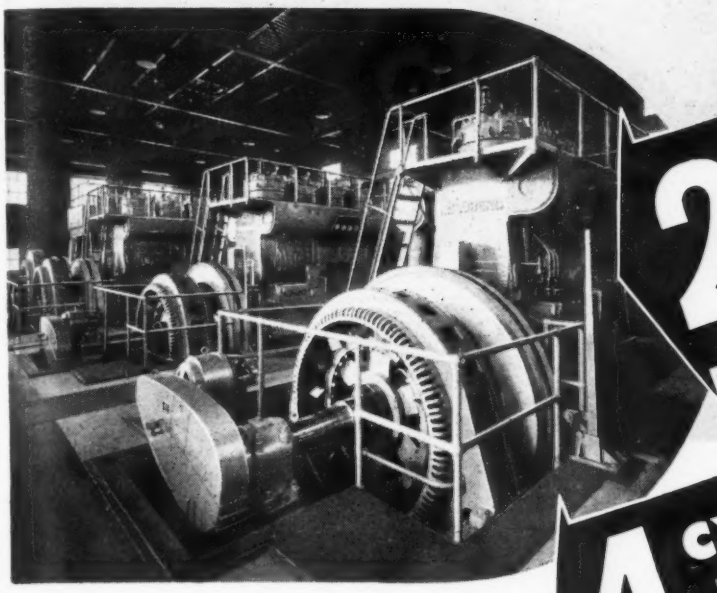
It happens all the time — to every man who is on top of his job.

Why? Because he keeps a weather eye out for the things that promise a better, faster, more economical way of doing something.

He knows that America's leading manufacturers take the newest and best of their products and services to market in the advertising pages of the business and industrial magazines that help him keep on top of his job. And if *it's for him* he wants to know what makes it tick.

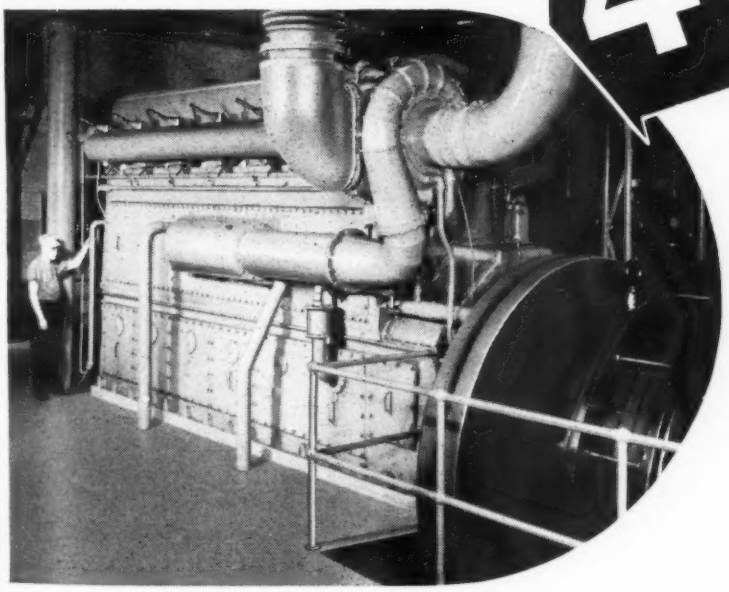
**To keep in touch with the parade - - - - - -**
**READ THE ADS.**

# A NORDBERG DIESEL
## will supply your power needs



**2 CYCLE ENGINES**
Available in sizes up to 8500 B. H. P. in a single unit.

**4 CYCLE ENGINES**
Built in non-supercharged and supercharged designs in sizes up to 1600 B.H.P.



As a builder of both two and four-cycle oil or gas burning Diesel engines, Nordberg can supply the power needs of plants small and large and a type engine best suited to each requirement. Back of these engines is a record of many years of successful performance that has won for Nordberg a position of leadership in the Diesel power field. The many repeat orders from satisfied users attests to this fact. For dependable, low cost power, investigate the merits of Nordberg Diesels. Our engineers will gladly furnish further particulars on an engine to meet your power demands.

**NORDBERG MFG. CO., Milwaukee 7, Wis.**

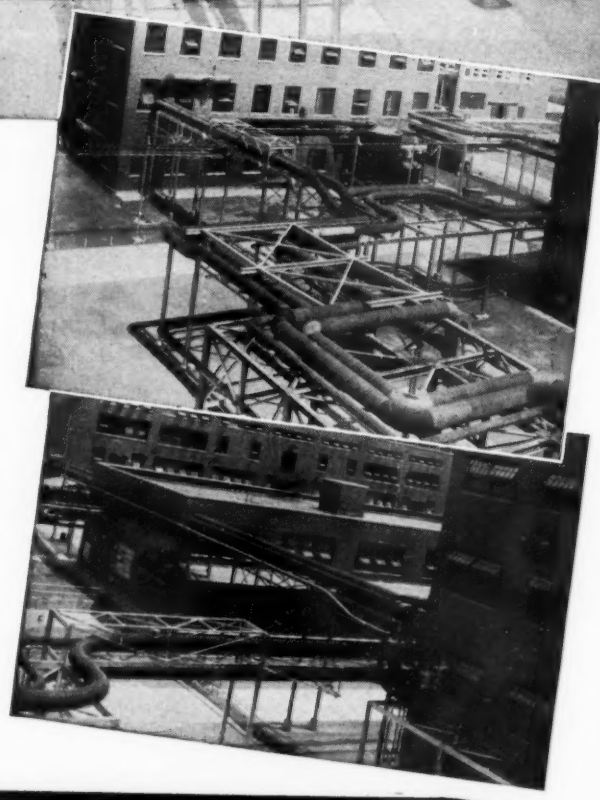
**NORDBERG**
**DIESEL ENGINES**

# SKILLED ENGINEERING

The difficulties encountered in the fabrication and erection of Central Station and Industrial Piping are many and varied.

The high degree of skill acquired by Navco Engineers from long experience in solving unusual Piping problems is your assurance of economy and safety of operation.

*Consult Navco for your next Piping Job.*



## NAVCO PIPING

NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

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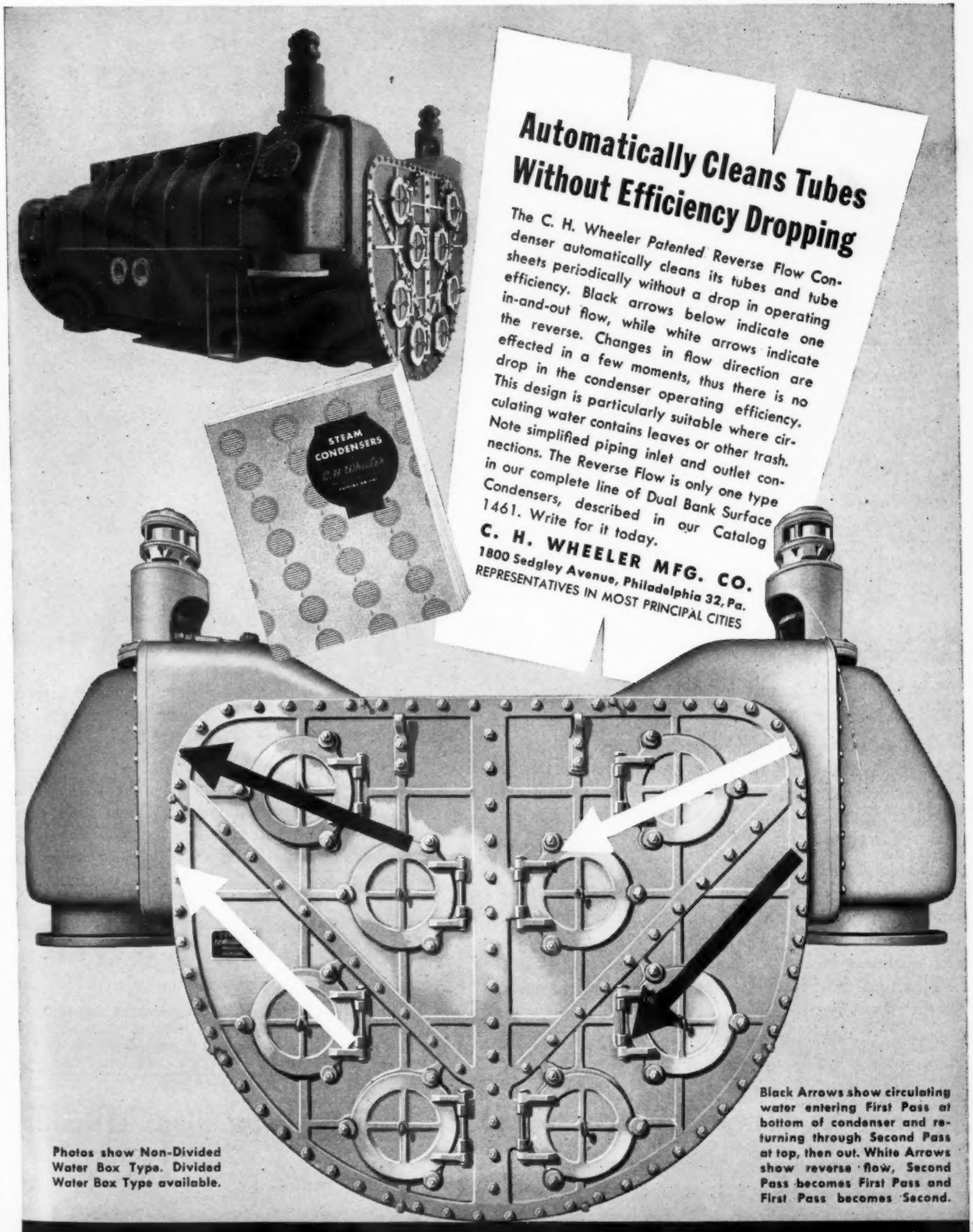



## Automatically Cleans Tubes Without Efficiency Dropping

The C. H. Wheeler Patented Reverse Flow Condenser automatically cleans its tubes and tube sheets periodically without a drop in operating efficiency. Black arrows below indicate one in-and-out flow, while white arrows indicate the reverse. Changes in flow direction are effected in a few moments, thus there is no drop in the condenser operating efficiency. This design is particularly suitable where circulating water contains leaves or other trash. Note simplified piping inlet and outlet connections. The Reverse Flow is only one type in our complete line of Dual Bank Surface Condensers, described in our Catalog 1461. Write for it today.

**C. H. WHEELER MFG. CO.**
1800 Sedgley Avenue, Philadelphia 32, Pa.
REPRESENTATIVES IN MOST PRINCIPAL CITIES

Photos show Non-Divided Water Box Type. Divided Water Box Type available.

Black Arrows show circulating water entering First Pass at bottom of condenser and returning through Second Pass at top, then out. White Arrows show reverse flow, Second Pass becomes First Pass and First Pass becomes Second.

C.H. Wheeler OF PHILADELPHIA

STEAM CONDENSERS · AIR EJECTORS
COOLING TOWERS · HEAT EXCHANGERS

# *From clue to conclusion for 2¢*

How much does it cost for light to read the latest murder mystery from cover to cover?

For an average-speed reader the power used probably costs two cents or less . . . amazingly little for the convenience and service. To the public, abundant electric power—*at reasonable cost*—is more or less taken for granted.

One important factor, often overlooked, lies behind plentiful, cheap power. This is the alertness of power producers in their constant search for better, more efficient methods. Typical of the industry has been its readiness to invest in new, improved equipment . . . a matter of intelligent and far-sighted spending "here" to make important savings possible "there."

For many years, American Blower has worked with the power industry—specializing in products designed to increase overall plant efficiency. You may already be familiar with American Blower mechanical draft fans—dust precipitators—and Gyrol Fluid Drives for both fans and boiler feed pumps.

For complete technical information on all American Blower products, contact the nearest American Blower Branch Office. You will find these offices staffed by experienced engineers familiar with your problems.

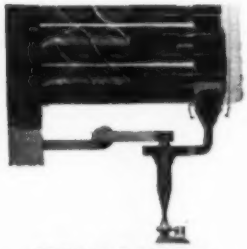
**AMERICAN BLOWER**

DETROIT 32, MICHIGAN

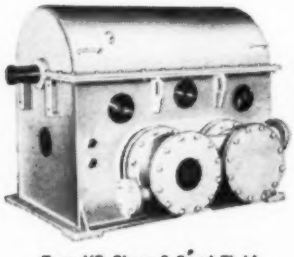
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

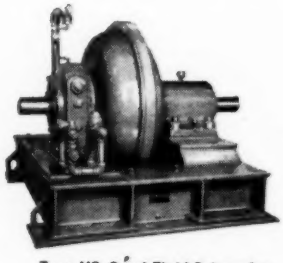
## 4 American Blower Products to improve overall power plant efficiency



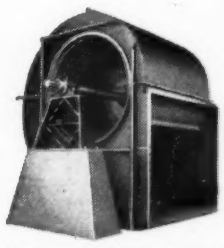
ST Fly Ash Precipitators —especially for power plants burning powdered fuel.



Type VS Class 6 Gyrol Fluid Drive—for adjustable speed control of boiler feed pumps.



Type VS Gyrol Fluid Drive—for adjustable speed control of mechanical draft fans.



HS and Sirocco Fans for forced or induced draft in all types of power plants.

# NO YEAST - *NO BREAD*

# NO SCRAP - *NO STEEL*

QUALITY V YOUNGSTOWN SERVICE

**YOUNGSTOWN**

THE YOUNGSTOWN SHEET AND TUBE COMPANY

GENERAL OFFICES - YOUNGSTOWN 1, OHIO

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Manufacturers of

CARBON - ALLOY AND YOLOY STEELS

Pipe and Tubular Products - Sheets - Plates - Conduit - Bars - Rods - Wire - Electrolytic Tin Plate - Coke Tin Plate - Cold Drawn Carbon Steel Rounds - Tie Plates and Spikes.

REMEMBER this--It requires large quantities of scrap to produce each ton of prime new steel. So to increase the possibility of making more steel available, turn in your scrap through your regular channels. Do it now! Keep it coming!

*Keep Your*

***Coal Bins, Hoppers and Chutes***

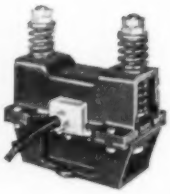
## Open and Free-Flowing!

*with*

SYNTRON

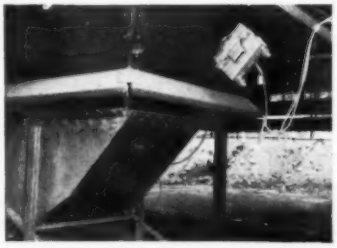
*"Pulsating Magnet"*

## ELECTRIC VIBRATORS



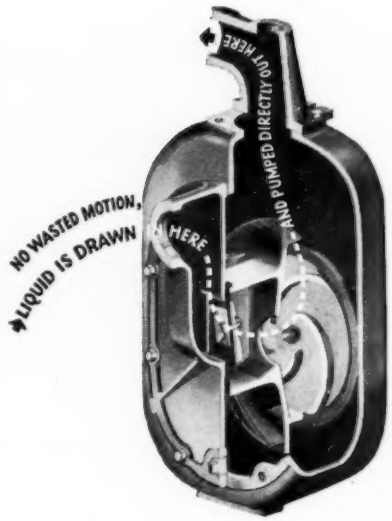
**3600** powerful, pulsating vibrations per minute break down arching and plugging—eliminate pounding and sledging.

Write for Folder I-44, or send us a dimensional sketch, giving gauge of hopper walls, etc.



**SYNTRON CO.**
492 Lexington
Homer City, Pa.

## Place this Centrifugal Pump ABOVE THE LIQUID



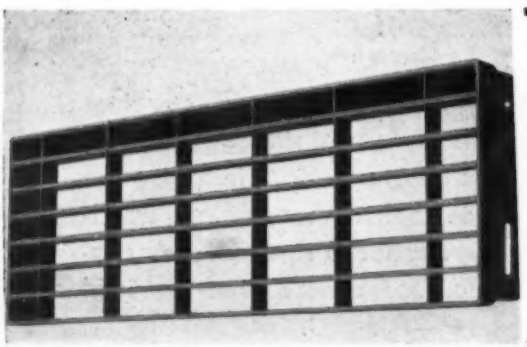

A Marlow Self-Priming Centrifugal provides the advantages of centrifugal action—plus inherent ability to prime automatically on high suction lifts. Direct action . . . no wasted motion. 1½ to 10-inch sizes; 25 to 3500 GPM. Data sent promptly. Marlow Pumps, 592 Greenwood Ave., Ridgewood, N. J.

**MARLOW PUMPS** • *Manufacturers of Quality Pumps Since 1924*

## Nosing Bar has Dual Advantages on MITCO SHUR-SITE TREADS

Here's a patented, double-value feature of Hendrick Mitco Shur-Site Treads. The heavy, flanged nosing bar makes each step distinctly visible, for accident prevention, and it also provides additional strength at the point of heaviest loading. Shur-Site Treads have all the other Mitco constructional advantages, including non-slipping, non-clogging surfaces.

Write for detailed information on Mitco Shur-Site Treads, Mitco Open Steel Flooring and Mitco Armorgrids.



SEE OUR CATALOG IN SWEET'S

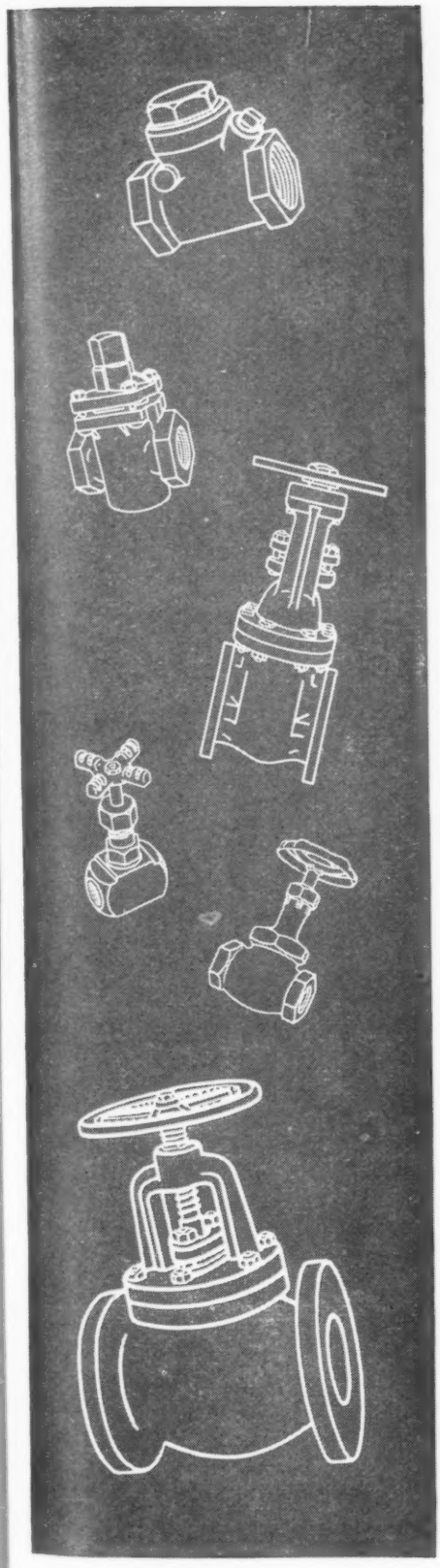
Perforated Metals
Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and
Armorgrids

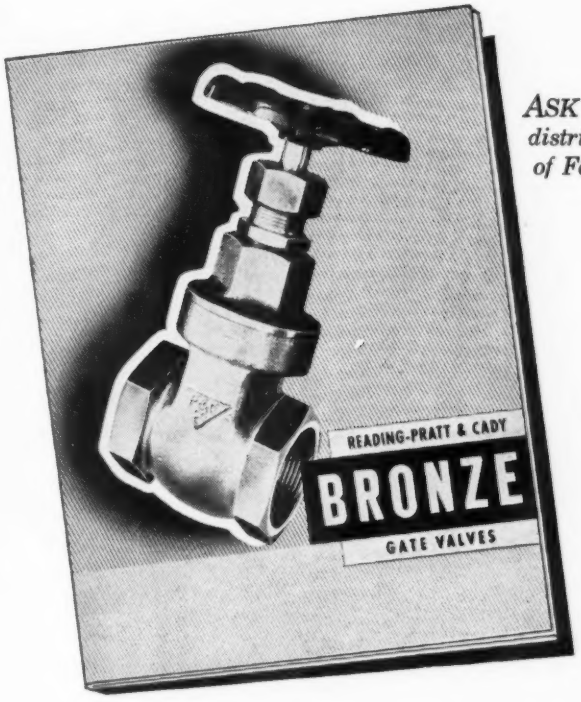
# HENDRICK

*Manufacturing Company*

**46 DUNDAFF STREET, CARBONDALE, PENNA.**

*Sales Offices In Principal Cities*






*ASK your R-P & C distributor for a copy of Folder DH-1166*

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**Reading-Pratt & Cady offers a wide range of high quality Bronze Gate Valves—every one designed, built and rigidly tested to ensure top performance. This folder—a condensed catalog—deserves a place in your files.**

READING, PA.—Body and bonnet of every R-P & C Bronze Gate are sound castings of fine-grained valve Bronze with uniform wall thickness. Wedges are reversible and renewable—an economy feature. In the larger sizes, seat rings are renewable in the line. Heavy stems of high-tensile rolled brass have clean-cut machined threads to ensure continued smooth operation. Every Bronze Gate that leaves the R-P & C factory is given an extra final air test—to make sure of mechanical perfection.

Ask your Reading-Pratt & Cady distributor about bronze, iron and steel gate, globe, angle and check valves—iron cocks and Lubrotite gate valves—Bar Stock valves of bronze, carbon steel and alloy steels—cast steel fittings.

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Reading, Pa. • Atlanta • Baltimore • Boston • Chicago • Denver • Detroit • Houston • Los Angeles • New York • Philadelphia • Pittsburgh • Portland, Ore. • San Francisco • Bridgeport, Conn.

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**Contains a wealth of Valuable Data on PREVENTIVE MAINTENANCE of Commutators and Slip Rings**

Make sure your files contain a copy of this handy reference guide—for all sizes of motors and generators. It illustrates and describes the latest methods and equipment for commutator and slip ring maintenance, including Ideal Resurfacers, Cleaning Stones, Brush Seaters, Undercutters, etc. Write now for your copy of this Free Book!

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**IDEAL INDUSTRIES, Inc.**
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1023 Park Avenue — Sycamore, Illinois

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- Apply directly over any rusted surface.
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- Easy to apply—an important saving in time and manpower.
- Covers up to twice the area per gallon of paint.

Rust-Oleum is the most effective rust and corrosion preventative . . . No other protective coating equals it in safeguarding metal. Rust-Oleum penetrates rust—incorporates it with the film—and forms a tough, elastic coating that outlasts paint two or three times. *Greater coverage and longer life mean extra low cost.*

**Ask your distributor or write direct for Catalog and free sample. Name the rusted item for test and tell the conditions that cause the rust**

**RUST-OLEUM CORPORATION**
2447 Oakton Street • Evanston, Illinois

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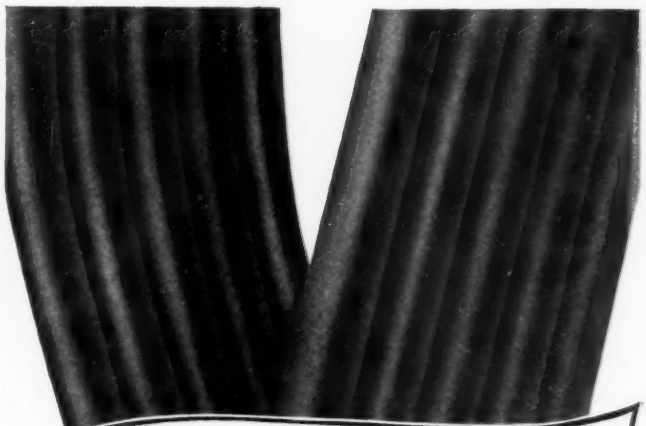


## Bent or Straight BOILER TUBES
*any size for any pressure*

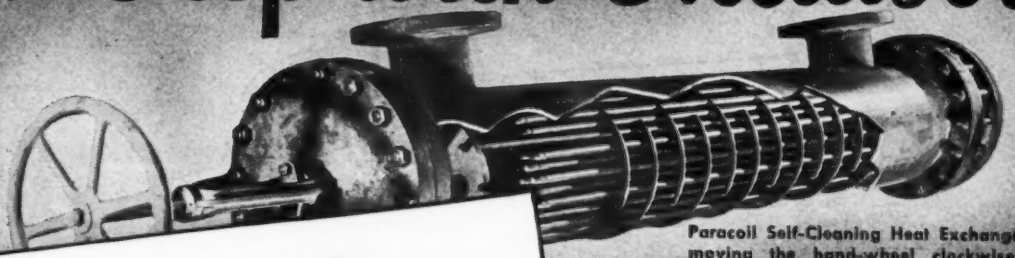
5

## BOILER TUBE CO. OF AMERICA

McKEES ROCKS, PA. (Pittsburgh District)

PITTSBURGH • CHICAGO
FRED S. RENAULD & CO., LOS ANGELES

# In Step with Industry



Paracoil Self-Cleaning Heat Exchanger. By moving the hand-wheel clockwise and counter clockwise the entire baffle-assembly is moved back and forth over the heating surface thus scraping any deposits from the tubes. Cleaning action is positive and effective. Ideal for heating fuel oil and other fouling liquids.

## Paracoil

### HEAT TRANSFER EQUIPMENT

Davis Engineering Corporation has played a major part in the development, design betterment and manufacture of distillation, evaporation and heat exchange equipment for more than 30 years.

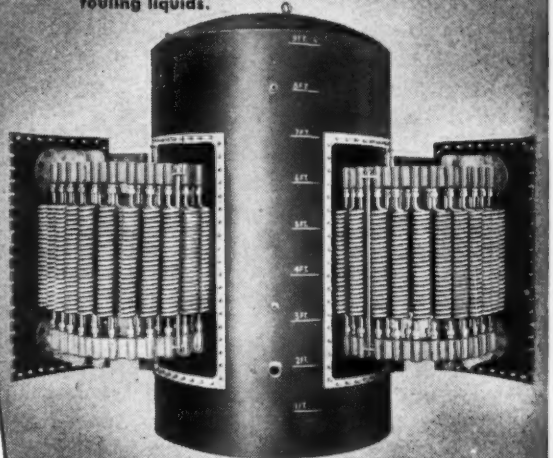
Pictured are Paracoil Heat Transfer units designed to serve America's industries as well in peace as they served the country during the war. Davis built heat exchangers assure greater production efficiency, reduced repair and cleaning costs and freedom from shutdown losses.

Paracoil equipment is available for practically every type of heat transfer application called for by our many and varied industries.

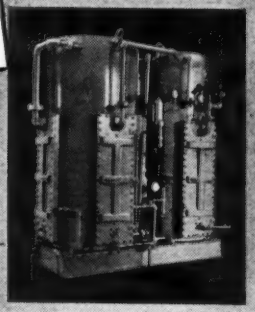
Technical and practical knowledge accumulated from 30 years of manufacturing experience and job performance, supplemented by continuous engineering research, have resulted in fundamental design improvements effecting advanced performance and increased resistance to severe service conditions.

Whether yours is a replacement, new, or more efficient equipment need, Paracoil Heat Exchangers are available on most reasonable delivery schedules and Davis engineers are ready to assist in making proper selection of size and design best suited for your particular problems.

*To those with fouling problems:* Write for bulletin HE-100 describing the Paracoil Self-Cleaning Tubular Heat Exchanger.

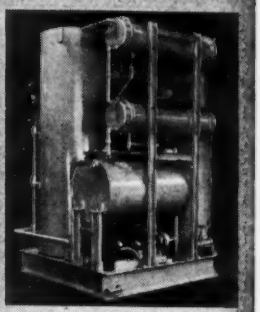


Paracoil Double-Door Evaporator. Note accessibility of all the heating surface for inspection, cleaning and ease of repair. Available in single and multiple effects and in a wide range of capacities.



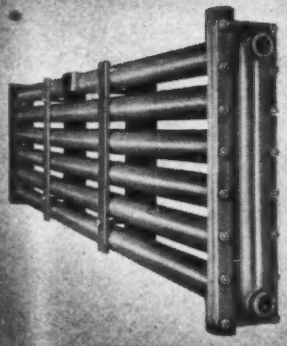
FRONT VIEW

Triple Effect Package Type Distillation plant built for supplying distilled water from sea water or contaminated water for drinking and process service. Illustrates Paracoil hinged door evaporators. A completely self contained unit.



BACK VIEW

This distillation unit has a capacity of 180 gallons per hour with low pressure steam and economical steam consumption. Other package types standardized for a number of capacities.



Gas to Gas Heat Exchanger. This type of Paracoil Heat Exchanger has many industrial uses for transfering heat between gases or liquids, or between gases and liquids. Unit illustrated constructed entirely of Inconel. Can be furnished in other alloys or carbon steel.

Liquid to Liquid Exchanger. Special liquid to liquid exchanger for counter current flow, six pass on both shell and tube sides. Most efficient design for crossing temperature conditions. Straight tubes easily cleaned.

SINCE 1915
Paracoil
HEAT TRANSFER EQUIPMENT

DAVIS ENGINEERING CORPORATION
1066 EAST GRAND STREET, ELIZABETH 4, NEW JERSEY

# How To Save Time and Money on Maintenance Jobs

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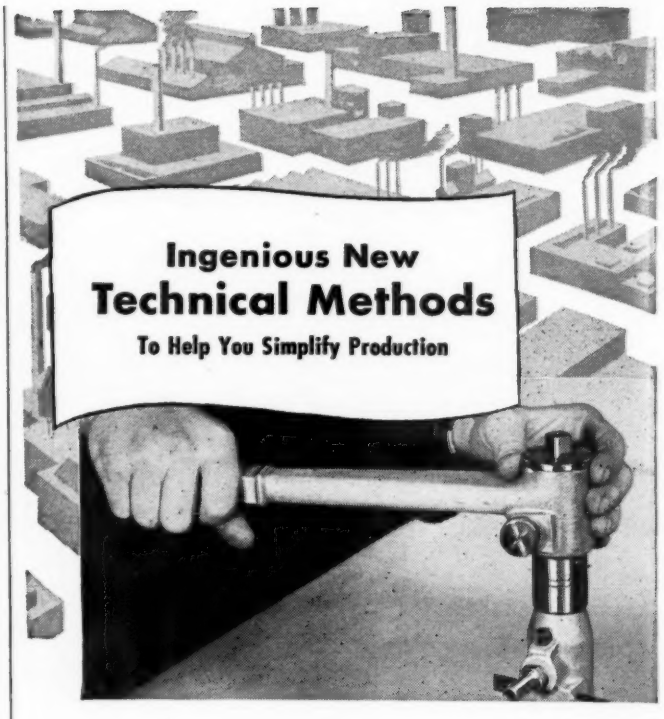


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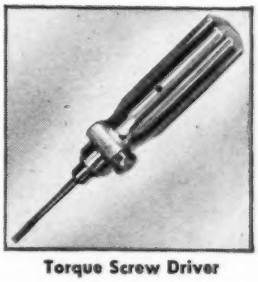
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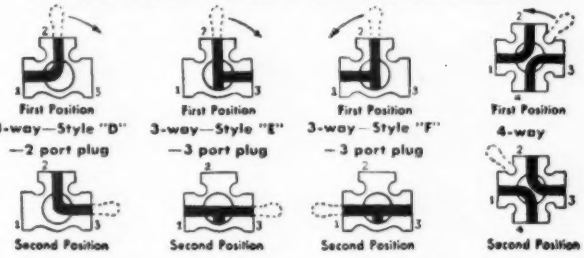


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# Increasing Condenser Efficiency and Tube Life

## *Removal of Slime and Biofouling*

Every power engineer recognizes the necessity for getting the best possible performance out of his condensers because condensers play a vital part in the efficient operation of the entire plant.

### Slime Reduces Heat Transfer

Regardless of whether a power plant uses sea water or fresh water, an important factor in the efficient operation of the condensers is the slime which accumulates on tubes (sheets and water boxes) interfering with heat transfer and causing a drop in condenser vacuum which may make a difference of hundreds, or even thousands of dollars a year.

Formation of slime occurs on both ferrous and copper-base alloys, but generally to a lesser extent on the copper-base alloys. Also, though steel or concrete may disintegrate beneath bacterial slime in many instances, such action has not been observed with copper-base alloys.

### How Slime Contributes To Premature Tube Failure

Accumulation of slime may cause serious trouble in several ways. For example, in recent years it has been found that slime on condenser tubes in seaboard as well as inland power plants actually consists of living organisms (microalgae and bacteria). These organisms are known to give off such substances as carbonic acid, hydrogen sulfide, sulfuric acid, ammonia, nitrites, etc., which play an important part in the corrosion of metals. It appears that slimes also make it easier for barnacles, oysters, mussels, etc., to attach themselves to metal surfaces.

### Keeping Tubes Free from Slime

There are a number of methods for removing slime from condenser tubes. In many cases chlorine or chlorine and ammonia are effective when injected into the circulating water periodically.

When much chlorine is required to kill the accumulations of bacteria and algae, chloramine solutions made by dissolving equal parts of bleaching powder and ammonium sulfate have been used. Sodium hypochlorite is also used in the circulating water by some power plant operators.

Another procedure which is followed consists of filling up the condenser with a weak sodium hypochlorite solution and allowing it to "soak" for several hours.

The amount of chlorine or chlorine compound varies considerably. It must be borne in mind that such cleaning should be carefully supervised since excessive dosages may have an adverse effect on metals, by dissolving the protective film.

### Cleaning Without Chemicals

Some operators clean their condenser tubes regularly with high pressure air or water applied at the exit end. For twenty-four hours hot air at about 120° F. is passed from the generator air ducts into the condenser while steam, at approximately 140° F., is slowly passed through the steam space and vented. The slime which shrinks and curls up is then removed by applying a high pressure water jet. Similar results have been obtained by opening up the condenser for a long enough period to dry out accumulated deposits of slime through normal air circulation. This is followed by the application of a water jet. It is important to remove completely the dried-up slime, since small patches remaining on a tube surface may become starting points for localized corrosion or pitting. Pushing rubber plugs through the tubes is the regular practice in many plants.

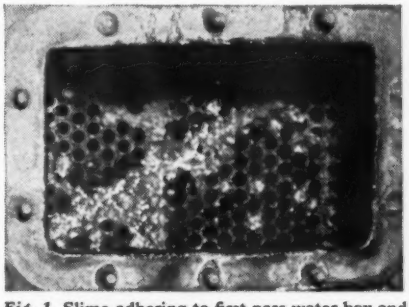

*Fig. 1.* Slime adhering to first-pass water box and tube sheet of condenser in power plant located on Gulf Coast.

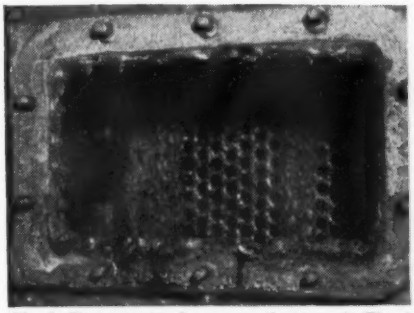

*Fig. 2.* Photograph of same condenser as in Fig. 1 showing condition of water box and tube sheet on second pass. Note the lesser amount of tube stoppage.

### Large Organisms Also Troublesome

Other sources of trouble are large marine growths, both plants and animals, which do not accumulate readily on most copper-base alloys, but do attach themselves to steel, cast iron, and concrete with the result that circulating tunnels, pipe lines, fire and flushing lines may become clogged. In one New England seaboard power station more than 200 tons of shells are removed each year from the tunnel walls and floors.

Such organisms as barnacles, oysters and mussels not only may block the condenser tubes but may also deflect the cooling water, causing a stream to impinge against the tube wall. This results in premature failure of condenser tubing as discussed in the May 1947, Copper Alloy Bulletin. When these organisms die, their decomposing tissues form substances which tend to destroy the protective film of the condenser tubing and encourage pitting.

### Use of Screens

Much trouble can be avoided right from the start if intake tunnels are kept clean and fine screens are used to prevent fouling organisms, shells and debris from reaching the first-pass water box. This is emphasized by the fact that generally the greatest difficulty is experienced in the first pass of two-pass condensers, so widely used in power plants. More tubes usually fail in the first-pass than in the second. This is because tubes in the first pass act as a screen and collect the fouling organisms and debris. See Figures 1 and 2.

### Use of Corrosion-Resistant Alloys Important

One of the best ways to insure efficient condenser operation and guard against premature tube failure is to use the proper corrosion-resistant condenser tube alloy. Bridgeport manufactures a number of corrosion-resistant alloys designed to meet a wide range of operating conditions. Laboratory-trained men who have had long experience in corrosion research are available to aid in the selection of that particular alloy which will be best for a given set of conditions. Arrangements can be made for consultation through the nearest Bridgeport office.

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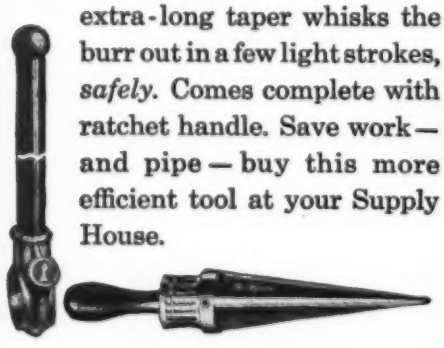

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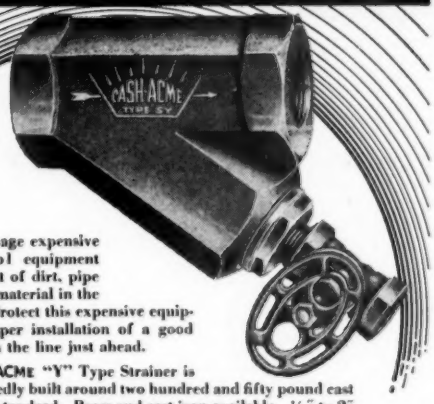


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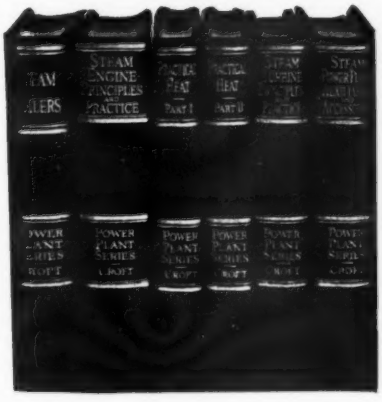

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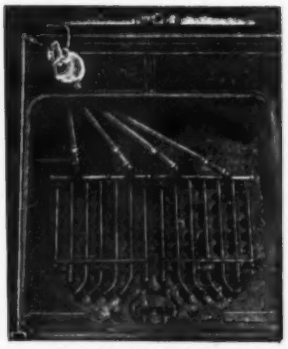

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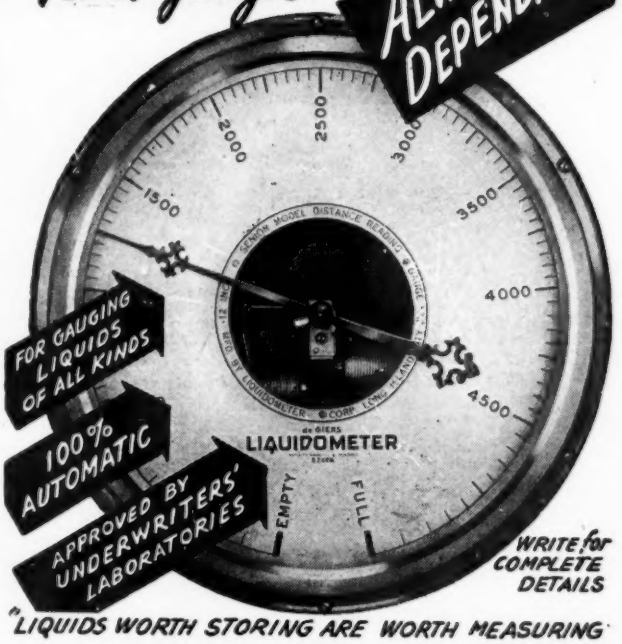


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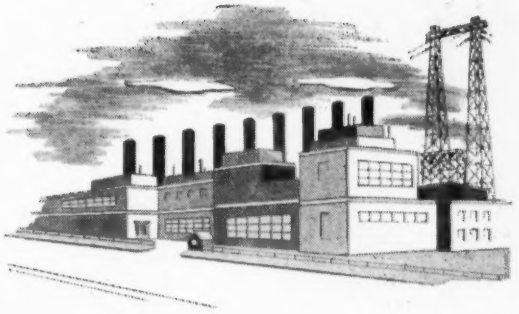

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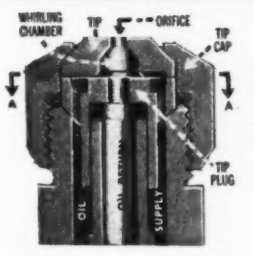
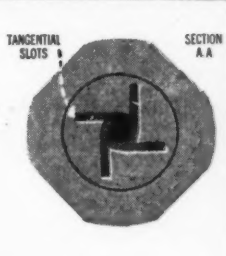
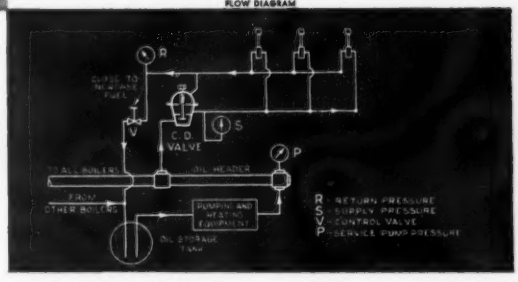
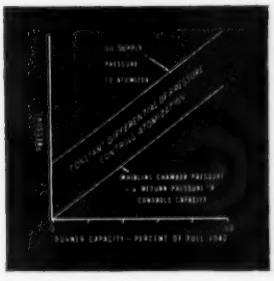
## DEMAND PEABODY BURNERS



Explanation of the Peabody CD Wide-Range Differential Valve System

***The capacity of the burners can be varied over a very wide range by regulating the return pressure (R) by means of the control valve (V) which regulates the quantity of oil returned to storage. An increase in pressure (R) increases pressure (S).***

## PEABODY ENGINEERING CORPORATION

580 FIFTH AVENUE • NEW YORK 19, N. Y.

ATLANTA, GA. · BOSTON, MASS. · CHICAGO, ILL. · CLEVELAND, O. · DENVER, COLO. · DETROIT, MICH. · HONOLULU, T.H. · HOUSTON, TEX. · KANSAS CITY, MO. · LOS ANGELES, CALIF. · NEW ORLEANS, LA. · PHILADELPHIA, PA. · PORTLAND, ORE. · SAN FRANCISCO, CALIF. · ST. LOUIS, MO. · ST. PAUL, MINN. · SEATTLE, WASH.

MONTREAL, CAN. · MEXICO CITY, MEX. · BUENOS AIRES, ARGENTINA

PEABODY LIMITED, LONDON

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**ASSOCIATED ENGINEERS, Inc.**
Joseph C. Lewis, *President*
*Management Consultants*
Engineering . . Architecture . . Accounting
Organization . . Methods . . Costs
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**DERBYSHIRE MACHINE & TOOL COMPANY**
*Manufacturing Engineers*
FLUID FLOW LABORATORY
Complete Facilities
for Testing, Development and Research on
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*Engineering Divisions*
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New York Philadelphia
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**ELECTRIC CONSTRUCTION COMPANY**
*Engineers—Contractors*
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of
Power Plant, Sub Stations
Transmission and Distribution Lines
Modern Equipment
Philadelphia, Pa.

**GILBERT ASSOCIATES, INC.**
ENGINEERS AND CONSULTANTS
*Industrial and Utilities*
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*Steam — Diesel — Hydro*
Reports—Examinations—Laboratory
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61 Broadway Washington, D. C.
New York 17 & Sansom St., Phila., Pa.

**KEGARISE-CRONK ENGINEERING CORP.**
*Engineers - Consultants*
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Steam and Electric Distribution Systems
Steam and Electric Utilization
Design — Reports — Plans
334 E. Main St. *P.O. Box* 668 Johnson City, Tenn.

**T. MASENG & ASSOCIATES, Inc.**
*Engineer*
Electrical, Design — Structural, Reports — Mechanical Rates
7 So. Dearborn Chicago 3, Ill.

**LUKE L. NAKASHIAN**
*Engineer*
PROCESS STEAM PLANTS
POWER PLANTS
OIL REFINERY EQUIPMENT
404 Park Square Building. Boston 16, Mass.

**PUBLIC UTILITY ENGINEERING & SERVICE CORPORATION**
CONSULTING ENGINEERS
Design Operations
Steam · Hydraulic - Gas
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**REYNOLDS, SMITH AND HILLS**
ENGINEERING CONSULTANTS
Specialists in Design and Construction of Industrial and Central Station Plants
Reports, Analyses and Surveys
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AND
CONSTRUCTORS

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Power Plants — Design — Water — Steam Utilization — Consultation — Reports — Plans
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**WHITMAN, REQUARDT AND ASSOCIATES**
Engineers-Consultants
Power Plants — Industrial Plants
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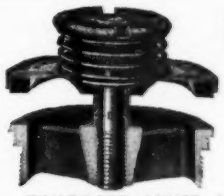
Reports—Plants—Supervision—Appraisals
1304 St. Paul Street Baltimore 2, Md.


# WHERE TO BUY

**Featuring additional products, specialties & services for power plants**

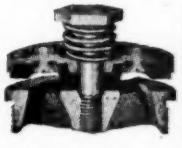



**BIRCH Pump Valves**
*Standard In*
**RAILROADS, MINES, WATER WORKS, INDUSTRIALS**
● They increase efficiency, capacity, economy—decrease slippage, leakage, fuel consumption—will not sink in seat ports, warp, break, curl, or ride seat bridges. For hot or cold water service . . . thoroughly dependable!
BIRCH MANUFACTURING CO.
1521 Sedgwick St., Chicago, Ill.

**TEST SPEEDS and SAVE.—At a glance**
REVOLUTIONS and FEET per min.
SPEED VARIATIONS
BELT CLIPPAGE
Send for Bulletin
O-Z Improved Hand Tachometer-Cutmeter
O. ZERNICKOW CO.
21 Park Row New York

**THREAD ROLLING, INC.**
*Precision Threads and forms.*
Class 3, 4 and 5 threads,
Aviation Products - Diesel Studs - Taps - Hollow Parts, etc.
Threading after heat treating
Prompt Quotations from Blue Prints.
332 GRAND STREET, HOBOKEN, N. J.
Hoboken 4-1826.

***End Pump Troubles!***
**HILL IMPROVED PUMP VALVES**



● The valve with the renewable feature restores old pumps to original efficiency. Constant contact is maintained over the full bearing surface no matter in what position the valve rotates because of the exclusive HILL design. Efficient, durable, economical, accurate. Send today for bulletin that tells how to get better pump performance.
HILL PUMP VALVE CO.
2728 ELSTON AVE. CHICAGO 47, ILL.


*MAKE it your habit to check, each issue, the announcements appearing on the Where To Buy page. They supplement other advertising in Power of products and services essential to modern power plant operation.*

## Crippling Loss or Quick Extinguishment?

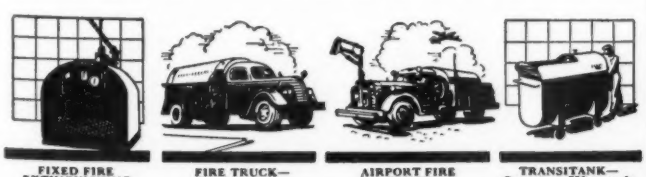
● If a tough, fast-moving fire attacks your plant, is your on-the-spot fire fighting equipment *big enough* and *fast enough* to assure a quick victory?

Cardox Fire Extinguishing Systems . . . using the distinctive Cardox methods of engineered control and application that have greatly broadened the scope of $CO_2$ fire protection . . . provide outstandingly fast and effective protection for one or many critical or major hazards.

A Cardox Fire Extinguishing System is engineered to definite fire protection standards . . . to provide *all* the advantages of $CO_2$ extinguishment, unhampered by any practical limitations on the amount of extinguishing medium available, in seconds. By the distinctive Cardox method, carbon dioxide is stored at 0° F. and relatively low pressure in a single ¼ ton to 125 ton storage unit . . . assuring enough Cardox $CO_2$ to handle even large fires and have ample reserve for new emergencies.

Cardox Engineering and Research Staffs will welcome the opportunity of helping you evaluate accurately the plus value of a Cardox System in the protection of your specific operation.

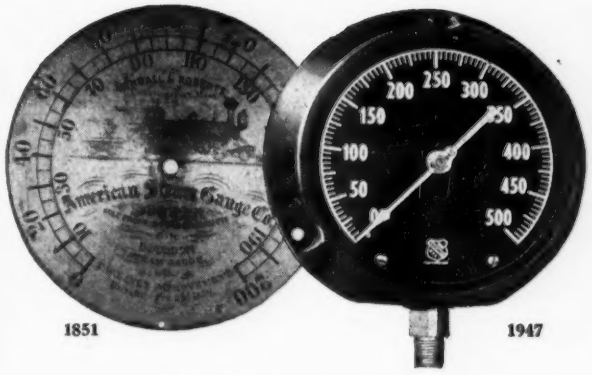
**CARDOX CORPORATION**
**BELL BUILDING • CHICAGO 1, ILLINOIS**
*District Offices:* New York • Philadelphia • Pittsburgh • Cleveland
Detroit • St. Louis • San Francisco • Los Angeles • San Diego



FIXED FIRE EXTINGUISHING SYSTEMS | FIRE TRUCK—Tons of $CO_2$ on Wheels | AIRPORT FIRE TRUCK | TRANSITANK—Capacity—750 pounds

# CARDOX

**$CO_2$ FIRE EXTINGUISHING SYSTEMS**




## Still first

IN 1851 Mr. George H. Ashcroft returned from the first International Industrial Exposition in London with exclusive rights from M. Bourdon of Paris to manufacture the FIRST Bourdon tube gauges ever to be built in the United States.

From 1851 until today, Ashcroft has continued to be FIRST with every major improvement in gauge development and design.

Ashcroft research produced the FIRST Welded Steel Gauge tube and perfected both alloy and stainless steel tube designs to their present advanced state of development. The Rotary Geared Movement, the Micrometer Pointer, the Laminated Phenol Dial, the Turret Case, are all FIRSTS which have contributed to keep Ashcroft ahead in accuracy, durability, and in the actual number of gauges in service throughout the nation.

Today, backed by the entire research and precision manufacturing facilities of Manning, Maxwell & Moore, Ashcroft is still FIRST with engineers who cannot afford to compromise the safety and efficiency of their plant, or the quality of their product.

*Stocked and sold by leading Distributors everywhere . . . When you order gauges, insist on ASHCROFT . . . Write for booklet.*

MANNING MAXWELL & MOORE INC. TRADE MARK

# ASHCROFT *Gauges*

*A Product of*
**MANNING, MAXWELL & MOORE, INC.**
**BRIDGEPORT 2, CONNECTICUT**
Makers of Ashcroft Gauges, Hancock Valves, Consolidated Safety and Relief Valves and 'American' Industrial Instruments.

# SEARCHLIGHT SECTION

## EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

**UNDISPLAYED RATE:**
*(Not available for equipment advertising)*
90 cents per line, minimum 4 lines. To figure advance payment count 6 average words as a line and allow 10 words for a publication box number address.
POSITIONS WANTED (full or part-time individual salaried employment only), ½ the above rates.
PROPOSALS, 75 cents a line insertion.

**INFORMATION:**
BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

**DISPLAYED RATE:**
This advertising rate is $10.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. P.

*NEW ADVERTISEMENTS received by July 9th will appear in the August Issue, subject to limitation of space available*

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## DESIGNERS

### MECHANICAL—STRUCTURAL —ELECTRICAL

With experience on design for Commerical and Industrial Buildings, including Chemical Plants, Power Plants and Laboratories.

**MECHANICAL** — Designers and checkers for Air Conditioning Pressure Vessels, Process and Power Piping, Plumbing, Sewer and Underground Piping.

**STRUCTURAL** — Designers for Structural Steel and Reinforced Concrete. Must be capable of checking drawings.

**ELECTRICAL** — Designers for Power and Lighting Layout.

Applicants for Design positions should be willing to perform board work in connection with their own designs.

Openings in our Cleveland and New York Offices.

Lengthy employment offering good salary for those who qualify.

Send complete resume stating experience, education, salary requirements and date of availability to either of the following addresses

**THE H. K. FERGUSON COMPANY**
*Engineers and Builders*
FERGUSON BUILDING
East 11th and Walnut, CLEVELAND, OHIO
or
19 Rector Street, New York, N. Y.

---

**WANTED**
## ENGINEERS
Wanted by Michigan firm of engineers, men qualified for structural and mechanical design, drafting, and construction supervision on power plant work. Answer to
P-276, Power
520 North Michigan Ave., Chicago 11, Ill.

---

**MECHANICAL ENGINEERS**
WITH 5 TO 15 YEARS EXPERIENCE
In Design of Steam Electric Generating Stations or Gas Plants
*Write to*
MECHANICAL ENGINEER
PENNSYLVANIA POWER & LIGHT CO.
Allentown, Pa.

---

**MECHANICAL ENGINEER**
WITH 15 TO 20 YEARS EXPERIENCE
In The Design of Steam
Electric Generating Stations
FOR ADMINISTRATIVE POSITION
With a Large Eastern Utility
P-335, Power
330 West 42nd St., New York 18, N. Y.

---

### POSITIONS VACANT

TECHNICAL GRADUATES (especially chemical, electrical) under 30, returned from military services have excellent opportunity for permanent place with nationwide engineering organization. After period, work as junior engineer will include traveling for consultation among leading industrial plants. P-320, Power, 330 W. 42nd St., New York 18, N. Y.

POWER PLANT Supervisor, Texas, age 40 to 50, must be skilled in operation and maintenance of turbines and gas fired boilers. P-327, Power, 520 N. Michigan Ave., Chicago 11, Ill.

GRADUATE MECHANICAL Engineer wanted: Must be experienced in operation and management of modern steam plant, and capable of supervising operating personnel. Permanent position with well known electric utility in Northwestern Ohio. Write full particulars about age, experience, salary requirements to P-329, Power, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED—CHIEF Electrician—familiar with all electrical installation and maintenance of Diesel Power generating industrial plant. Nylen Products Company, St. Joseph, Michigan, phone 3-1528.

WANTED—ASSISTANT Power Engineer for mid-western industrial plant having 14,000,000 lbs. per day steam capacity and 16,000 KW electric capacity. Must be college graduate age 25-30. Both mechanical and electrical engineering experience desirable. Write full details and qualifications. Address to Personnel Department, A. E. Staley Mfg. Co., Decatur, Ill.

REQUIRED BY Nicaraguan gold mine—two capable, experienced diesel engineers for heavy duty diesel engines. Starting salary $300 monthly with board and lodging. Must report single status for few months. Transportation furnished, Spanish desirable but not essential. Give full training and experience. P-339, Power, 330 W. 42nd St., New York 18, N. Y.

### SELLING OPPORTUNITY OFFERED

MANUFACTURER OF industrial electronic instruments, established more than ten years, is open for representation in Southern Ohio, Michigan and Minnesota. Would like to hear from established organizations contacting power plants and process industries. RW-330, Power, 330 W. 42nd St., New York 18, N. Y.

### EMPLOYMENT SERVICES

SALARIED POSITION $2,500-$25,000. This thoroughly organized confidential service of 37 years recognized standing and reputation carries on preliminary negotiations for supervisory, technical and executive positions of the calibre indicated, through a procedure individualized to each client's requirements. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL $3,000-$25,000. This confidential service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 109 Church Street, New Haven, Conn.

---

**POWER SALESMAN**
Splendid opportunity for advancement for man who qualifies—Midwest community—fairly concentrated territory serving 750,000 people. Applicant should be around thirty-five years of age and have at least ten years experience in power sales work. State qualifications and enclose snapshot. Replies confidential.
SW-302, Power
520 North Michigan Ave., Chicago 11, Ill.

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## SALES REPRESENTATIVE

Salary basis, for New York City and vicinity. Age under forty. Must have experience in sale of accessories for steam plants or similar position requiring acquaintance with power boiler operation and maintenance. Rare opportunity for salesman with executive aptitude to affiliate with thirty-year-old manufacturer. *Write Sales Manager.*

**THE DAMPNEY COMPANY OF AMERICA**
Hyde Park, Boston 36, Massachusetts

---

### POSITIONS WANTED

PLANT ENGINEER—37, college graduate, professional registration. 17 years experience buildings, building equipment, utilities and distribution systems including construction, design, maintenance and operation. Now employed in executive capacity. Desires position with future. PW-328, Power, 330 W. 42nd St., New York 18, N. Y.

ENGINEER—DESIRES position in Southwest Texas, Oklahoma, Missouri, Louisiana, Ohio, Illinois, preferred. Four years experience with oil and gas fired boilers, low and high pressure. Feed water treatment. Maintenance and upkeep of boiler room auxiliaries and boiler. Some sales experience. Age 22. Married. Will send full details, references and picture on request. PW-331, Power, 68 Post St., San Francisco 4, Calif.

MAINTENANCE SUPERVISOR or Plant Engineer. Age 36. College 3 years. Experience 14 years in maintenance, construction, and operation of large boilers, turbines, and associated equipment. Familiar with A.S.M.E. codes and modern technique of power plant maintenance including high pressure steam pipe and boiler welding, machine shop, and electrical. Capable of supervising all work on large boilers and turbines. Experience in supervising men. References. PW-332, Power, 520 N. Michigan Ave., Chicago 11, Ill.

ATTENTION—SOUTH American Countries. Plant Engineer, American, age 50, health excellent, married, no children, degree in mechanical and electrical engineering, twenty-five years background in various electrical and mechanical fields, practical and technical experience combines, electrical and mechanical industrial layouts, plant expansion and new building construction and design. Thoroughly qualified in general maintenance and machine shop practice, eleven years with public utilities, fourteen years with industrials. Available within four to six weeks from date of acceptance of offer. Minimum salary considered $7500.00 per year. PW-340, Power, 330 W. 42nd St., New York 18, N. Y.

(Continued on opposite page)

## POSITIONS WANTED

(Continued from opposite page)

CHIEF SUPERVISING Engineer, maintenance, generator, refrigeration. Can furnish war department references. If profitable will work in Illinois. Twenty years experience. PW-333, Power, 520 N. Michigan Ave., Chicago 11, Ill.

### Available Representation In Southeast

Professional engineer, operating out of Chattanooga, Tenn., wishes to represent manufacturers of Power Plant, Industrial and Electrical Equipment. Exceptionally familiar with territory, financially responsible, experienced in sales. Superior references.

RA-338, Power
330 West 42nd St., New York 18, N. Y.

### NEED NEW ENGLAND REPRESENTATION

Established Manufacturers' agent with experienced men seeks additional reputable line. Covering industrial N. E. except Connecticut.

RA-336, Power
330 West 42nd St., New York 18, N. Y.

### CASH PAID

For Capital Stock or Assets of

INDUSTRIAL ENTERPRISE

• WANTED •

*By large financially powerful diversified organization wishing to add another enterprise to present holdings.*

*Existing Personnel Normally Retained*

Box 1234, 1474 Bway, N.Y. 18, N.Y.

### For Immediate • SALE •

**Generators, D.C., 2—500 KW, 1—300 KW, 1—200 KW 120/240 volt. Switchboards. Rice & Sargent engines, 100 RPM, 130 lbs pressure. Plant discontinued.**

FS-341, Power
330 West 42nd St., New York 18, N. Y.

### FOR SALE

1—Used Sturtevant Steam Engine, Serial No. 66173, Size 11 x 9, Type VS-7, 328 RPM, with throttling governor,—78 HP. In good condition.

1—Used 200 HP Type CS, 2300 Volts, 3-Phase, 60 Cycle, 1200 RPM Westinghouse Squirrel Cage Induction Motor, with Reduced Voltage Starter. In excellent condition.

1—Used Sturtevant #996 TVID, Serial No. 300632, Design 2, Induced Draft Fan, BP C-15-10488-B, and spare repair parts. In good condition.

FS-342, Power
330 West 42nd St., New York 18, N. Y.

## WANTED

### —TRANSFORMERS—

**TRANSFORMERS WANTED**

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes

ALL TRANSFORMERS GUARANTEED FOR ONE YEAR

THE ELECTRIC SERVICE CO., INC.

"AMERICA'S USED TRANSFORMER CLEARING HOUSE"

MARIEMONT Since 1912 CINCINNATI 27, OHIO

### WANTED TURBO-GENERATOR

Aprox 2500 KVA 2300/3/60 180# pressure 60# + or — Extraction.

**Not over 15 years old**

EVANS PRODUCTS COMPANY

Coos Bay, Oregon

*Cash Ready*

FOR YOUR

### ELECTRICAL EQUIPMENT

Electric motors, AC and DC
Compensators
Generators
Motor Generator Sets
Air and Oil Circuit Breakers
Panels
Exhaust Fans
Control Equipment

*Send us list with full details*

WIRE OR PHONE
P. O. Box 534

POWER EQUIPMENT CO.
373 SO. GOODMAN ST., ROCHESTER 7, N. Y.
Phone Hillside 2041

### WANTED Two D.C. MOTORS

TYPE MPC, CLASS 6—150 H.P. 500. Form A, 500 R.P.M. 250 Volts, General Electric—150 H.P.

W-973, Power
330 West 42nd St., New York 18, N. Y.

### WANTED EXPLOSION PROOF MOTOR

1—50 HP, 1800/3600 RPM, 440 volt, 3 phase, 60 cycle, constant torque 2 speed explosion proof motor.

THE NEW YORK AIR BRAKE CO.
WATERTOWN, NEW YORK

### Air Compressors Wanted

Horizontal Water Cooled—Any size also 2 Stage portable units

L. W. BAUER
North Bergen, N. J.

### WANTED One M. G. Set

150-200 K.W.—125 Volt, Compound Interpole D.C. Generator—Driven by 220-3-60 Synchronous A.C. Motor of suitable size. Manual reduced voltage starter, suitable accessories acceptable.

OHIO VALLEY GENERAL HOSPITAL
Wheeling, West Virginia

### TRANSFORMERS WANTED

**usable or burnt-out**

*IN - STOCK*

***1—1000 KVA-GE Single Ph.***
***2—750 KVA-Pittsburgh—Single Ph.***
***1—30 KVA-GE Constant Current***

Zenith Transformer Co.
1733 N. 5th St. Phila. 22, Pa.
Poplar 5-0353

### WANTED FOR CASH

2000 to 2500 KVA, and will consider 3000 KVA, 3 phase, 60 cycle, 2300 volts, 3600 RPM non-condensing turbine-generator unit, 200 lbs. pressure, 450 to 500° TT, 10 lbs. gauge back. Must be in good condition.

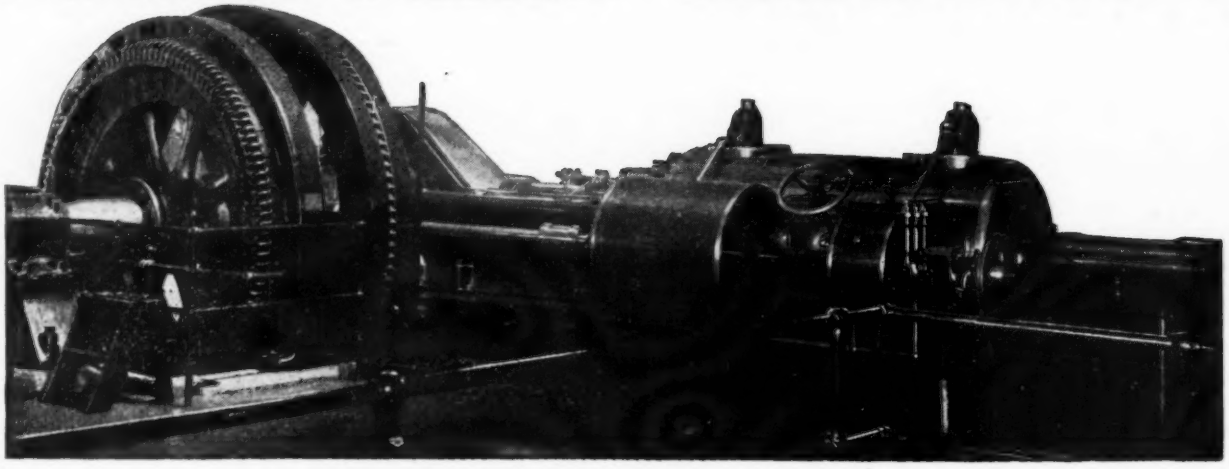
W-337, Power
520 North Michigan Ave., Chicago 11, Ill.

### WANTED TRANSFORMER

1—3000 to 4000 KVA 3 phase transformer or equivalent single phase bank. 11.5 KV primary, 2400/4160 secondary. (12 KV primary would be considered). Write

W-316, Power
330 West 42nd St., New York 18, N. Y.

# POWER PLANT MACHINERY



**750 KVA NORDBERG UNIFLOW ENGINE GENERATOR UNIT**

**600 KW 80% P. F. 750 KVA General Electric alternating current generator, 3 phase, 60 cycle 4000/2300/600/480/240 volts, 150 RPM, direct connected to Nordberg uniflow noncondensing engine, 150–200# steam pressure, 0–15# backpressure. This unit is in excellent condition, available for immediate delivery.**

## CONDENSING TURBO UNITS

**3 phase 60 cycle**

12500 KVA Wstgh. 2400 volts 200# steam
5000 KVA G.E. 2400 volts 200# steam
3750 KVA Wstgh. 4160 volts 200# steam
2500 KVA G.E. 480 volts 150# steam
2250 KVA G.E. 480 volts 400# steam
1875 KVA G.E. 480 volts 225# steam
1563 KVA Allis 2400 volts 200# steam
1250 KVA G.E. 480 volts 150# steam
1250 KVA G.E. 600 volts 250# steam
937 KVA G.E. 480 volts 150# steam
375 KVA G.E. 480 volts 400# steam

## EXTRACTION TURBO UNITS

**3 phase 60 cycle**

3750 KVA Wstgh. 2400 volts 150# steam 10# extraction
1875 KVA G.E. 480 volts 225# steam 15# extraction
1250 KVA Allis 480 volts 300# steam 35# extraction
940 KVA Wstgh. 600 volts 150# steam 20# extraction
625 KVA Wstgh. 480 volts 250# steam 25# extraction

## BOILERS

175,000 lbs/hr Combustion Engineering 450 lbs. steam, pulverizer
90,000 lbs/hr Combustion Engineering 550 lbs. steam 700 deg. T.T., pulver.
50,000 lbs/hr Springfield 225 lbs. steam, 500 deg. T.T., pulverizer
37,500 lbs/hr Heine 400 lbs. steam, 620 deg. T.T., oil burner
35,000 lbs/hr Foster Wheeler 325 lbs stm. 570 deg. T.T., oil burner
30,000 lbs/hr B&W 525 lbs. steam 600 deg. T.T., pulverizer

## NONCONDENSING TURBO UNITS

**3 phase 60 cycle**

2500 KVA G.E. 480 volts 150# steam, 15# exhaust
1875 KVA Wstgh. 2400 volts 200# steam, 10# exhaust
1563 KVA Kerr 2400 volts 200# steam, 15# exhaust
937 KVA Moore 2400 volts 175# steam, 20# exhaust
937 KVA Wstgh. 480 volts 400# steam, 60# exhaust
750 KVA G.E. 480 volts 115# steam, 5# exhaust
625 KVA Wstgh. 480 volts 300# steam, 10# exhaust
375 KVA G.E. 240 volts 150# steam, 10# exhaust
250 KVA G.E. 480 volts 200# steam, 5# exhaust
187 KVA G.E. 480 volts 250# steam, 15# exhaust

## MOTOR GENERATOR SETS

**3 phase 60 cycle**

1800 KW G.E. 125/250v D.C. 4000v A.C.
1000 KW G.E. 250v D.C. 2300/4000v. AC.
500 KW Elliott 250v D.C. 2200v A.C.
200 KW C.W. 125v D.C., 2200v A.C.
125 KW G.E. 250v D.C., 440v A.C.
100 KW Elliott 250v D.C., 2200v A.C.

## ROTARY CONVERTERS

**3 phase 60 cycle**

3500 KW G.E. 225/285v D.C., 13800v A.C.
2000 KW Allis 600v D.C., 4150v A.C.
1500 KW Wstgh. 600v D.C. 4000v A.C.
1500 KW Wstgh. 250v D.C., 2300v A.C.
1000 KW Wstgh 250v D.C., 2300v A.C.
500 KW G.E. 60v D.C., 33000v A.C.

## UNIFLOW UNITS

**3 phase 60 cycle**

750 KVA Skinner, 2400 volts, 175# steam, 15# exhaust
375 KVA Skinner, 2400 volts, 150# steam, 5# exhaust
200 KVA Skinner, 240 volts, 150# steam, 5# exhaust

## UNIFLOW UNITS

**250 Volts Direct Current**

750 KW Skinner, 150# steam, 5# exhaust
500 KW Skinner, 150# steam, 5# exhaust
300 KW Skinner, 150# steam, 5# exhaust
250 KW Skinner, 150# steam, 5# exhaust
200 KW Skinner, 150# steam, 5# exhaust

## DIESEL UNITS

**3 phase 60 cycle**

575 KVA McIntosh-Sey 2400v 225 RPM
519 KVA Fairbanks-Morse 2400v 400 RPM
500 KVA McIntosh-Sey 2400v 225 RPM
432 KVA Worthington 2400v 360 RPM
365 KVA Worthington 2400v 360 RPM
250 KVA Fairbanks-Morse 2400v 257 RPM
185 KVA Fairbanks-Morse 2400v 300 RPM
100 KVA Fairbanks-Morse 240v 300 RPM

## GENERATORS

**3 phase 60 cycle**

2000 KVA G.E. 480 volts, 300 RPM
1500 KVA G.E. 600 volts, 300 RPM
1250 KVA G.E. 2400 volts, 720 RPM
1150 KVA Wstgh. 600 volts, 400 RPM
1000 KVA G.E. 2400 volts, 720 RPM
650 KVA G.E. 600 volts, 360 RPM
625 KVA Wstgh. 2400 volts, 720 RPM
588 KVA E. M. 2400 volts, 327 RPM

**INTERNATIONAL POWER MACHINERY CO.**

**UNION COMMERCE BLDG. Telephone Main 9514 CLEVELAND 14, OHIO**

# ROLLING UP NEW RECORDS FOR REAL VALUES!

# HEMPHILL EQUIPMENT

## REBUILT AND TESTED BY OUR ELECTRICAL ENGINEERS TO N.I.S.A. STANDARDS

### MOTOR GENERATOR SETS

1—500 KW General Electric MPC, 230 v., 720 RPM, ATI, 2200/4150 volt, 3 phase, Syn.
1—125 KW Crocker Wheeler 125V, 1200 RPM, 2300 V., Squirrel Cage.
1—100 KW Elec. Mach. 125 V., 1200 RPM, 4150 volt, synchronous.
1—100 KW General Electric, 230 v., 900 RPM, TS 4150 v. syn.
1—50 KW Ridgeway 1200 RPM, 550 Volt, Motor Sq. Cage, 220 volt.
1—17 KW Allis Chalmers, 8 Unit, 125 Volt, Sq. Cage, 1800 RPM.
1—5 KW General Electric, AC Gen., 1800 RPM, 120 volt, single phase, DC Motor, 230 volt.

### ENGINE GENERATOR SETS

1—150 KVA General Electric, Ames Uniflow 220 volt, 3 phase, non-condensing.
1—62½ KVA Westinghouse 240 volt, 3 phase, Fairbanks non-condensing.
2—13 x 15 Uniflow Engines 150/300 RPM for Ice Compressors.
1—200/273 volt Gasoline Van Blerck 8 cyl. 1500 RPM.

### TURBO GENERATOR SETS

1—300 KW General Electric ATB 240 Volt, 3 phase, condensing.
1—60 KW, General Electric DC 125 volt, 3600 RPM, Elliott Turbine.
1—30 KW Allis Chalmers 3600 RPM, 125 volt, Terry Non-Condensing.

### TRANSFORMERS

1—1500 KVA Allis-Chalmers, 3 phase, 4150Y to 480 volt.
2—500 KVA Allis Chalmers single phase, 7800/13800 Primary, 115/230 secondary.
3—150 KVA General Electric, Type HT, 3 phase, 27080 Primary, 125/216Y Secondary.
1—200 KVA Pittsburgh 4000 volt, single phase 110/220 volt secondary.
2—100 KVA Westinghouse, 13200 volt, 250 volt, single phase.
2—100 KVA Westinghouse 11430 volt, 250 volt, single phase.
1—37½ KVA Pittsburgh 2200 volt primary, 120/240 volt, secondary single phase.
1—37½ KVA General Electric, 2400 volt primary, 120/240 volt secondary, single phase.
10—27½ KVA General Electric brand new Air Cooled 440/220 220/110 single phase.
3—10 KVA Westinghouse Air Cooled, 450 volt, primary, 117 Volt secondary, single phase.
1—7½ KVA Westinghouse, 2200 volt primary, secondary 220/440 220/110, single phase.
1—7½ KVA American 2200 volt primary, 230 volt, single phase .
1—7½ KVA Maloney 440 volt primary 110/220 secondary, single phase.

### A. C. GENERATORS

500 KW General Electric .8 PF, 3600 RPM, ATB, 600 RPM, DC exciter.
240 KW General Electric .8 PF, 600 RPM, ATB, 600 RPM, DC exciter.
200 KVA Allis Chalmers, 3600 RPM, 240 volt, 2 phase, DC exciter.
200 KVA Westinghouse 600 RPM, 240 volt, 3 phase, DC Exciter.
200 KVA Allis Chalmers, 900 RPM, 240 volt, 3 phase, DC Exciter.
180 KW Westinghouse, 514 RPM, .8 PF, 550 volt, 3 phase.
2—167 KVA General Electric, 1200 RPM, .6 PF, 450 volt, 3 phase.
165 KW Electric Machinery, 514 RPM, 2400 volt, 3 phase.
120 KW, General Electric, ATB, .8 PF, 720 RPM, 2300 volt, 3 phase.
100 KW, General Electric, ATB, 600 RPM, 240 volt, 3 phase, DC Exciter.
62½ KW Allis Chalmers, 3600 RPM, 220 volt, 3 phase, DC Exciter
35 KW Columbia Elect. .8 PF, 1200 RPM, 240 volt, 2 phase, DC Exciter.
31.3 KVA American Custom .8 PF, 1200 RPM, 120/208 volt, 3 phase, DC Exciter.
12.5 KVA Westinghouse .8 PF, 1200 RPM, 240 volt, 3 phase, DC Exciter.

### SYNCHRONOUS MOTORS

200 HP Elec. Machinery, 450 RPM, 440 volt, 3 phase.
2—160 HP Electric Machinery, 1800 RPM, 2200 volt, 3 phase, DC Exciter.
150—HP Westinghouse, 900 RPM, 4150 volt, 3 phase, DC Exciter.
153 HP General Electric, T.S. 900 RPM, 4160 volt, 3 phase, DC Exciter.
100 HP General Electric T.S. 600 RPM, 440 volt, 3 phase, DC Exciter.
70 HP Electric Machinery, 180 RPM, 2200 volt, 3 phase.
40 HP Westinghouse, 1800 RPM, 220 volt, 3 phase, DC Exciter.
35—HP General Electric, 1200 RPM, 2200 volt, 3 phase, DC Exciter.
20 HP Westinghouse, 1800 RPM, .8 PF 220 volt, 3 phase.

### MOTORS—3 ph. 60 cycle

#### SQUIRREL CAGE

1—450 HP Ridgeway 900 RPM, 2200 volt, 3 phase.
2—50 HP General Electric, Type KT, 900 RPM, 220 volt, 3 phase.
3—40 HP General Electric, Type KT, 900 RPM, 220 volt, 3 phase.
1—35 HP General Electric, Type I, 600 RPM, 350 volt, 3 phase.
2—10 HP Westinghouse gear 440 RPM output 440 volt, 3 phase.

### MOTORS—3 ph. 60 cycle

#### SLIP RING

1—500 HP Lincoln 900 RPM, 440 volt.
1—450 HP General Electric, 425 RPM, ITC, 440 volt, 25 cycle.
1—100 HP General Electric, 720 RPM, IM, 440 volt, 25 cycle.
1—50 HP F & B, 1800 RPM, BV, 220 volt.
1—50 HP General Electric, 900 RPM, IM, 440 volt.
1—40 HP Cont. 1150 RPM, SA55, 220 volt.
1—40 HP General Electric, 1130 RPM, MT, 220 volt.
1—40 HP General Electric, 900 RPM, MT, 220 volt.
1—40 HP, General Electric, 900 RPM, MT, 2200 volt.

THIS SEAL IS YOUR GUARANTEE

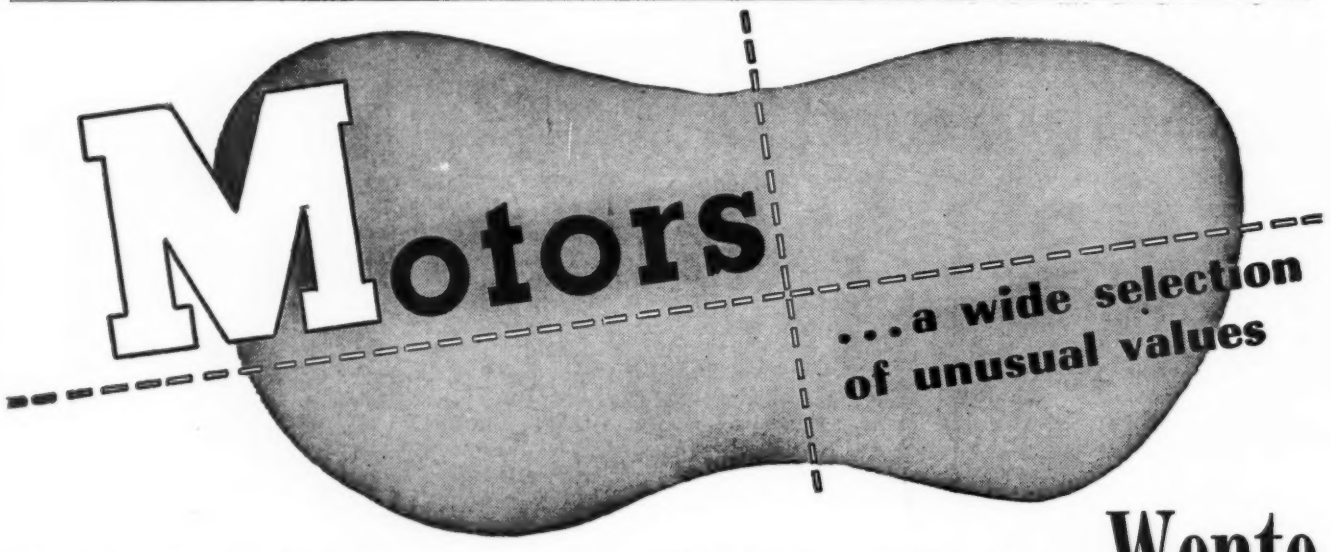
"FOR POWER"

J. L. HEMPHILL & CO.

1604 53rd STREET, NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227

PHONE NEW JERSEY—UNION 3-2600




# Listed below a few of the motors available in a hurry from Wente

### SQUIRREL CAGE

**3 Phase, 60 Cycle, 220/440 Volt**
**(Other voltage as noted)**

| Qu | HP | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 250 | Al. Ch. | AN | 1200 |
| 1 | 250 | Al. Ch. | AR | 1200 |
| 1 | 250 | G.E. | KF Vert. | 3600 |
| 1 | 150 | Al. Ch. | | 1750 |
| 1 | 150 | G.E. | I-17 550 Volt | 400 |
| 1 | 150 | West. | CS | 345 |
| 2 | 125 | Cr. Wh. | 126Q | 430 |
| 1 | 120 | G.E. | FT | 3600 |
| 1 | 100 | Howell | SCBB | 1800 |
| 1 | 100 | G.E. | I-171 | 340 |
| 1 | 100 | G.E. | I-17A | 290 |
| 2 | 50 | R.&M. | L | 1200 |
| 1 | 50 | Al. Ch. | AN | 900 |
| 1 | 50 | G.E. | I 2200 Volt | 900 |
| 1 | 50 | F. M. | | 900 |
| 1 | 50 | G.E. | I | 720 |
| 1 | 50 | West. | MS 25 Cycle | 720 |
| 1 | 50 | Wagner | BM | 495 |
| 1 | 50 | Al. Ch. | | 490 |
| 1 | 40 | Al. Ch. | 2200 Volt | 1200 |
| 2 | 35 | Al. Ch. | 2 Phase | 900 |
| 1 | 35 | Al. Ch. | | 900 |
| 1 | 35 | G.E. | I 25 Cycle | 720 |
| 1 | 30/30 | West. | CS TEFCBB | 1800/900 |
| 1 | 30 | F. M. | QZC TEFCBBEP | 1200 |
| 1 | 30 | Cr. Wh. | | 900 |
| 2 | 30 | Al. Ch. | AN 2 Phase | 900 |
| 1 | 30 | Century | A8 | 720 |
| 1 | 25 | West. | CS | 1800 |
| 1 | 25 | Howell | | 1200 |
| 1 | 25 | F. M. | QZK B. B. New | 1200 |
| 1 | 25 | Wagner | BP | 1200 |
| 1 | 25 | Burke | EM3 | 900 |
| 1 | 25 | Lincoln | | 900 |
| 1 | 25 | Al. Ch. | AN | 720 |
| 1 | 25 | G.E. | M10 | 720 |
| 1 | 25 | West. | MS 25 Cycle | 600 |
| 2 | 20 | U. S. | 8C SPBB | 1800 |
| 2 | 20 | F. M. | QZK B. V. New | 1800 |
| 1 | 20 | West. | CS | 1800 |
| 1 | 20 | Howell | N Vert. B.B. New | 1200 |
| 1 | 20 | F. M. | KRV | 1200 |
| 1 | 20 | Cr. Wh. | | 900 |
| 1 | 20 | G.E. | I-K 2200 Volt | 900 |
| 1 | 20 | Cleve. | M | 900 |
| 1 | 20 | Al. Ch. | | 900 |
| 1 | 20 | West. | MS 25 Cycle | 900 |
| 1 | 15 | West. | MS (Elev.) | 720 |
| 1 | 15 | F. M. | HLS | 3600 |
| 4 | 15 | F. M. | QZK B. B. New | 1800 |
| 2 | 15 | West. | MS 25 Cycle | 715 |
| 1 | 10 | Al. Ch. | | 1800 |
| 1 | 10 | Imperial | EH B. B. | 1200 |
| 1 | 10 | West. | CS 25 Cycle | 725 |
| 5 | 7½ | G.E. | KT | 1800 |
| 1 | 7½ | West. | CS | 1800 |
| 3 | 7½ | Wagner | 11VRW | 1800 |
| 3 | 7½ | G.E. | KT | 1200 |
| 20 | 3 | Imperial | E (New) | 1200 |

Approx. 200 New motors from 2 HP—30 HP.

### SLIP RING & SYNCHRONOUS

**3 Phase, 60 Cycle, 220 or 440 Volt**
**(Other voltage as noted)**

| Qu | HP | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 443 | El. M. | Syn. | 900 |
| 1 | 300 | G.E. | ATI Syn. | 1800 |
| 1 | 200 | F. M. | BV | 600 |
| 1 | 150 | G.E. | MT | 720 |
| 1 | 100KW | G.E. | ATB Syn. | 900 |
| 1 | 100 | G.E. | I-16 2200 Volt | 450 |
| 1 | 75 | F. M. | BV 2200 Volt | 1800 |
| 1 | 75 | West. | (New) Syn. | 1200 |
| 1 | 60 | Ideal | AVX | 1200 |
| 1 | 50 | G.E. | I 25 Cycle | 700 |
| 1 | 50 | Al. Ch. | | 720 |
| 1 | 50 | Ideal | AV 2200 Volt | 600 |
| 1 | 40 | G.F. | MT | 1200 |
| 1 | 40 | Al. Ch. | | 1200 |
| 1 | 40 | G.E. | MT | 900 |
| 2 | 40 | West. | CW 2200 Volt | 900 |
| 2 | 40 | West. | CW | 900 |
| 2 | 40 | Al. Ch. | | 900 |
| 1 | 40 | West. | CI | 730 |
| 1 | 40 | Burke | EMV7 | 1150/550 |
| 1 | 35 | Al. Ch. | | 720 |
| 1 | 35 | G.E. | I-12 | 600 |
| 1 | 30 | Al. Ch. | 2200 Volt | 720 |
| 1 | 25 | Cr. Wh. | | 1200 |
| 1 | 25 | West. | CW | 720 |
| 1 | 25 | West. | MW | 720 |
| 1 | 25 | G.E. | MT Tot. Encl. | 600 |
| 1 | 25 | G.E. | MT | 400 |

### DC—230 Volt

| Qu | HP | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 130 | Cr Wh. | CMC 550 Volt | 1200 |
| 1 | 100 | G.E. | CD | 1200 |
| 1 | 100 | West. | SK | 1800 |
| 1 | 100 | G.E. | RC38 | 600 |
| 1 | 100 | G.E. | PCS 440 Volt | 400 |
| 4 | 100 | Cr. Wh. | CMC | 225/550 |
| 4 | 85 KW | West. | SK Dynamo-meter | 1200/2200 |
| 1 | 75 | Diehl | K11 | 700 |
| 1 | 60 | West. | SK 115 Volt (Vert.) | 1200 |
| 1 | 60 | G.E. | EF1 | 1200 |
| 3 | 50 | West. | SK | 1200 |
| 1 | 40 | Rel. | 440 Volt B. B. Vert. | 1800 |
| 1 | 40 | Rel. | 440 Volt B. B. Vert. | 1200/1800 |
| 1 | 25/40 | Cr. Wh. | CMC 440 Volt Vert. | 1200/1800 |
| 1 | 40 | Rel. | B. B. | 400, 1500 |
| 2 | 40 | West. | SK | 1200 |
| 1 | 40 | G.E. | RC | 1200 |
| 7 | 40 | West. | | 775 |
| 1 | 35 | G.E. | OMTEBB | 1300 |
| 1 | 35 | West. | SK | 1200 |
| 1 | 35 | Al. Ch. | | 1200 |
| 1 | 35 | G.E. | DLC | 700 |
| 2 | 30 | El. Dy. | 158 | 625/1250 |
| 5 | 30 | Rel. | 92TF | 1800 |
| 1 | 30 | Rel. | 131T 440 Volt (Vert.) | 1200 |
| 1 | 30 | G.E. | RC | 1200 |
| 1 | 30 KW | Al. Ch. | 110 Volt | 925 |
| 1 | 27½ | G.E. | CVC116 | 1800 |
| 1 | 25 | Cr. Wh. | CM 110 Volt | 900/1200 |
| 1 | 25 | Al. Ch. | E120 | 500/1500 |
| 1 | 25 | Rel. | 25P | 250/1000 |
| 1 | 25 | G.E. | RF | 300/900 |
| 1 | 25 | F. M. | IRC | 400/800 |
| 6 | 25 | West. | SK | 1200 |
| 7 | 25 | West. | SK | 850 |
| 2 | 20 | Rel. | 131T | 1000/2000 |
| 2 | 20 | West. | SK | 750/1500 |
| 1 | 20 | Diehl | K9 | 500/1000 |
| 1 | 20 | G.E. | CD | 400/1600 |
| 1 | 20 | G.E. | RF | 250/1000 |
| 1 | 20 | Lincoln | FKW B. B. | 1800 |
| 6 | 20 | Cr. Wh. | CMC Enclosed | 1800 |
| 1 | 20 | Cr. Wh. | CMC TEBB (Exp.) | 1200 |
| 1 | 20 | Rel. | 92T | 1200 |
| 2 | 20 | West. | SK | 1200 |
| 1 | 20 | West. | SK | 900 |
| 1 | 20 | G.E. | RC | 900 |
| 7 | 20 | West. | SK | 750 |
| 1 | 20 | West. | SK | 500 |
| 1 | 15 | West. | SK63 | 1800 |
| 1 | 15 | West. | SK113 Encl. | 1800 |
| 1 | 15 | F. M. | D B. B. | 1150 |
| 6 | 15 | Rel. | 66T | 1150 |
| 2 | 15 | Cr. Wh. | CCM | 1150 |
| 1 | 15 | Cr. Wh. | CCM Totally Encl. | 1150 |
| 1 | 15 | West. | SK83 | 1150 |
| 2 | 15 | West. | SK80L | 1150 |
| 1 | 15 | G.E. | CD | 1150 |
| 1 | 15 | West. | SK90 | 850 |
| 1 | 15 | West. | K5 Crane | 630 |
| 8 | 15 | Rel. | 92TF | 850/1700 |
| 2 | 15 | G.E. | CO Crane | 650/2700 |
| 1 | 15 | Rel. | 131T 115 V. | 600/1500 |
| 2 | 15 | West. | SK | 600/1200 |
| 1 | 15 | Rel. | 78T | 400/1600 |
| 1 | 15 | G.E. | RF11 | 400/1200 |
| 1 | 12½ | West. | SK | 750/1500 |
| 1 | 12 | G.E. | RF | 575/1725 |
| 1 | 10 | West. | SK7 | 850/1700 |
| 1 | 10 | G.E. | RF10 | 600/1800 |
| 1 | 10 | West. | SK90 | 600/1800 |
| 7 | 10 | West. | SK80L | 500/1500 |
| 20 | 10 | Al. Ch. | | 500/1000 |
| 1 | 10 | Rel. | 92TF | 400/1600 |
| 1 | 10 | West. | SK | 250/1000 |
| 6 | 10 | Cr Wh. | CM TEBB | 1800 |
| 1 | 10 | Century | R304 | 1800 |
| 15 | 10 | West. | SK | 1150 |
| 2 | 10 | West. | SK 115 Volt | 1150 |
| 3 | 10 | Rel. | 46TF | 1150 |
| 1 | 10 | G.E. | RC9 | 1150 |
| 2 | 10 | Rel. | 66TF | 850 |
| 2 | 10 | G.E. | RC | 850 |
| 3 | 10 | West. | SK70 | 850 |
| 1 | 10 | G.E. | RC29 550 Volt | 850 |
| 1 | 10 | Colonial | | 950 |
| 14 | 7½ | West. | SK33 | 1750 |
| 4 | 7½ | West. | SK60 | 850 |
| 20 | 5 | West. & Gen. Elec. | | 1750 |
| 20 | 5 | West. & Reliance | | 1150 |
| 35 | 5 | West. | SK43 | 850 |

Hundreds of other DC motors not listed.

28 New vertical, T.E.F.C.B.B., 3 Ph., 60 Cy., 220/440 volt as follows:
1—Fairbanks-Morse, 3 HP, ty. QZCU, Fr. 254, 1200 RPM Exp.
2—General Electric 3 HP, ty. K, Fr. 254, 1200 RPM
8—General Electric 7½ HP, ty. K, Fr. 324, 1200 RPM
8—Delco, 7½ HP, type C, Fr. 324, 1200 RPM
1—Howell, 7½ HP, type KV, Fr. 284, 1800 RPM
6—General Electric, 15 HP, type K, Fr. 365, 1200 RPM
2—Howell, 15 HP, type KV, Fr. 365, 1200 RPM

1—New General Electric 250 HP, type KF, Frame 549A, 440 volt, 3 phase, 60 cycle, 3600 RPM vert., direct connected to Bingham type 2, 22 stage, double case, 3600 RPM, 3820 head, 175 GPM

3—New Allis Chalmers 200 HP, type ABZ, 2300 Volt, 3 phase, 60 cycle, 3600 RPM, totally enclosed, fan cooled, ball bearing

1—150 KW Westinghouse synchronous M-G set, 275 volt DC, 4400 volt AC, 3 phase, 60 cycle, 900 RPM, AC control & DC panel
1—150 KW General Electric M-G set, 250/275 volt DC, 440 volt AC, 3 phase, 60 cycle, 900 RPM
1—100 KW Ridgeway synchronous M-G set, 250 volt DC, 2300 volt AC, 3 phase, 60 cycle, 1200 RPM AC control & DC panel
1—200 KW Burke synchronous M-G set, 250 volt DC, 440 volt AC, 3 phase, 60 cycle, 900 RPM with AC control & DC panel
1—30 KW Westinghouse M-G set, 125 volt DC, 2300 volt AC, 3 phase, 60 cycle, 1200 RPM, AC control & DC panel

6—Practically new 40 KW Reliance & General Electric variable voltage M-G sets, 250 volt DC, 230/440 volt AC, 3 phase, 60 cycle, 1800 RPM, complete with exciters, all control and drive motors. All motors ball bearing, enclosed. M-G set, exciters and control mounted in fan cooled enclosure. Drive motor G. E. type CD, frame 1441, 40 HP, 230 volt 400/1600 RPM, enclosed, ball bearing, 50° Cont. 250 RPM, 1 hr., 50°

The Wente Electric Co.

Hamilton, Ohio

**Rebuilt Motors & Generators**
***SINCE 1906***

# FAMOUS WORDS IN THE ELECTRICAL INDUSTRY:

# "Successful Operation Guaranteed"

WHAT MORE CAN YOU ASK?

## RE-NU-BILT EQUIPMENT

RE-NU-BILT BELYEA MOTORS

### MOTOR GENERATOR SETS

**3 ph. 60 cycle**

1—1000 KW Al. Ch. 450 V. d.c. to 1250 Kva 2300 V. Syn. Motor.

1—600 KW G.E. 3 unit with 2-300 KW 250 v. Gens. d.c. to 850 HP. 2300 v.

1—500 KW G.E. 600 V. d.c. to 700 HP—2300 V.

1—400 KW G.E. 3 Unit with (2) 200 KW 125 V. d.c. to 600 HP—2300 v. Syn.

1—375 KW—Whse 125 V. d.c. to 600 HP 2300/4000 V. Syn.

1—300 KW G.E. 550 V. d.c. to 435 HP—2300/4000 Syn. with exciter.

1—250 KW G.E. 275 V. d.c. to 350 Kva 2300/4000 Syn. with exciter.

1—250 KW Al. Ch. 250 V. d.c. to 340 Kva—2300 V.

1—150 KW Whse 250 V. d.c. to 250 Kva. 440 V. Syn. with exciter.

1—150 KW Whse 600 V. d.c. to 225 HP—2300 V.

1—75 KW G.E. 125 V. d.c. to 120 HP—4000/2300 V. Ind.

2—48 KW G.E. 3 unit with (2) 24 KW, 60 V. gens d.c. to 75 HP, 440 V. Ind.

1—35 KVA Whse. 240v., 3 ph., 60 cy. A.C. gen. with 35 HP—230 V. d.c. motor.

### FREQUENCY CHANGER SETS

**1—1000 KW—GE—2 Unit—3 Brg. Consisting of—1400 HP—4400 V. 3 ph. 25 Cy. Motor and 1000 KW—2300 V—2 ph. 58.3 cycle gen. with exciter (Gen. Can be reconnected for 800 KW 3 ph.)**

**1—840 KW—GE—2 unit with 2 exciters consisting of 1700 HP—2300 V. 3 ph. 25 cycle motor and 1200 Kva.—.7 pf. 2400 V. 3 ph. 60 cycle gen.**

**1—600 KW—GE—2 Unit Consisting of 850 HP—2300 V—3 ph. 25 Cycle Motor and 750 Kva.—.8 pf.—2300 V—3 phase—62½ cycle generator.**

**1—150 KW—Induction type, 2 Unit 4 Bearing—Generator 150 KW—type ITT—557—1800 RPM—500 Volt 3 ph. 120 cycle—Stator excitation 440 Volts with 100 HP—1800 RPM—440 Volt 3 phase 60 cycle Sq. Cage Motor**

### ROTARY CONVERTERS

**60 cycle**

| KW | Make | Speed | Volts | Volts |
|---|---|---|---|---|
| 1—1500 | Whse. | 720 | 600 | 2300 |
| 1—1000 | Whse. | 900 | 600 | 11000 |
| 1— 750 | Whse. | 900 | 600 | 13200 |
| 1— 750 | Whse. | 720 | 250 | 6600 |
| 1— 500 | Whse. | 1200 | 600 | 13200 |

### TURBO-GENERATOR SETS

1—5000 KVA G.E. 2300 V. 3 ph. 60 cy. with G.E. 435 lb. Condensing turbine.

1—3000 KW Whse. 3750 Kva. 2300 V. 3 ph. 60 cy. with Parsons 200 lb. Cond. turbine.

1—3000 KW G.E. 3750 Kva. 2300 V. 3 ph. 60 cy. with G.E. 200 lb. Cond. turbine.

1—2500 KW G.E. 3125 Kva. 600 V. 3 ph. 60 cy. with 200 lb.; 15 lb. auto extraction turbine.

1—2000 KW G.E. 6600 V. 3 ph. 60 cy. with G.E. 175 lb. Cond. turbine and d.c. exciter.

1—2000 KW G.E. 3125 Kva. 480 V. 3 ph. 60 cy. with 175/200 lb.; 25 lb. auto extraction.

1—1500 KW G.E. 1875 Kva. 480 V. 3 ph. 60 cy. with G.E. 200 lb. Cond. turbine.

2—1250 KW G.E. 1560 Kva. 2300 V. 3 ph. 60 cy. with G.E. 175/200 lb. Condensing turbine.

1—1250 KW G.E. 600 V. 3 ph. 60 cy. with G.E. 175 lb. Cond. turbine and d.c. exciter.

1—1250 KW Al. Ch. 1560 Kva. 2300 V. 3 ph. 60 cy. with 200 lb. Condensing turbine.

1—1000 KW G.E. 1250 Kva—2300 V.—3 ph. 60 cy. with G.E. 125 lb. and 16 lb. mixed pressure Condensing turbine.

2—1000 KW G.E. 1250 Kva—2300/4100 V. 3 ph. 60 cy. with G.E. 135/175 lb. Cond. turbine.

1—500 KW G.E. 625 Kva—240/480 V. 3 ph. 60 cy. with G.E. 200 lb. Cond. turbine.

1—500 KW Whse. 625 Kva. 440 V. 3 ph. 60 cy. with Parsons 145/175 lb. Cond. turbine.

1—300 KW G.E. 375 Kva. 480 V. 3 ph. 60 cy. with G.E. 80/100 lb. Cond. turbine.

1—300 KW G.E. 375 Kva. 480 V. 3 ph. 60 cy. with G.E. 200 lb., 10 lb. back pressure turbine.

1—300 KW Whse. 375 Kva. 480 V. 3 ph. 60 cy. with Whse. 250 lb., 5 lb. back pressure turbine.

1—300 KW Al. Ch. 120/240 V. d.c. geared to Whse. 440 lb. Cond. turbine.

1—200 KW G.E. 600 V. 3 ph. 60 cy. with 150 lb. non cond. turbine and exciter.

1—125 Kva. G.E. 2300 V. 3 ph. 60 cy. with 125/200 lb. Non-Cond. turbine.

1—100 Kva. Whse. 2400 V. 3 ph. 60 cy. with 125/200 lb. Non-Cond. turbine.

1—100 KW G.E. 600 V. 3 ph. 60 cy. with 200 lb. non-cond. turbine and exciter.

### SPECIAL

**1—2000 Amp. 3 PST. 15,000 V. Sol. operated, conduit, type, F-12—15 D. OCD.—1,000,000 KVA, interrupting capacity. Unused.**

### A. C. MOTORS

**3 ph. 60 cycle**

**SYNCHRONOUS**

| HP | Make | Type | Volts | Speed |
|---|---|---|---|---|
| 2—2100 | G.E. | ATI | 2300 4600 | 514 |
| 2— 600 | Al. Ch. | | 2300 | 720 |
| 2— 350 | G.E. | TS | 2200 | 150 |
| 1— 300 | Whse. | | 600 | 600 |
| 1— 200 | El. Mach. | | 440 | 900 |

**SLIP RING**

| | | | | |
|---|---|---|---|---|
| 1—1000 | Whse. | CW | 2300 | 705 |
| 1— 800 | Whse. | CW | 6600 | 443 |
| 1— 750 | Whse. | CW | 2200 | 327 |
| 1— 450 | Cr. Wh | SR-310 | 2300 | 392 |
| 1— 350 | G.E. | MT-442Y | 2200 4000 | 253 |
| 1— 250 | G.E. | MT-424Y | 4000 | 257 |
| 1— 100 | Al. Ch. | ANY | 220 | 435 |

**SQUIRREL CAGE**

| | | | | |
|---|---|---|---|---|
| 1—250 | G.E. | IK | 440 | 600 |
| 1—250 | Al. Ch. | AN | 220 | 1160 |
| 1—200 | Al. Ch't | AN | 2300 | 1160 |
| 1—200 | Al. Ch. | IK | 2300 | 1175 |
| 1—200 | G.E. | IK | 440 | 900 |
| 1—150 70 | G.E. | IK | 440 | 1170/870 |
| 1—100 | G.E. | IK (Vert.) | 2300 | 450 |
| 3—100 | G.E. | IK | 2200 | 600 |

### SPECIAL MERCURY ARC RECTIFIERS

**1—750 Kw—GE—Type RHW—6 Anode 575 V. D.C. Form C with 2300 V. 60 Cycle transformer and switching equipment.**

**1—500 KW—GE—Type RHW—6 anode 575 V. D.C. Form B with 2300 V. 60 Cycle transformer and switching equipment.**

### D. C. MOTORS

| HP | Make | Type | Volts | Speed |
|---|---|---|---|---|
| 2—800/1000 | Whse. | | 450 | 600 720 |
| 1—800 | G.E. | MPC | 600 | 600 |
| 1—700 | G.E. | MCF | 600 | 180 525 |
| 1—650 | G.E. | MPC | 250 | 115 145 |
| 2—350 | G.E. | MPC | 250 | 450 |
| 1— 335 | Whse. | MQ | 250 | 300 900 |
| 1—300 | G.E. | DMC | 230 | 400 600 |
| 1—300 | G.E. | MPC | 230 | 275 550 |
| 1—250 | G.E. | MPC | 230 | 400 500 |
| 1—150 | G.E. | MPC | 230 | 250 450 |
| 1—130 | Cr. Wh. | CMC-51H | 550 | 1200 |
| 2—125 | G.E. | CO-1832 | 230 | 625 |
| 1—125 | Whse. | | 240 | 240/600 |

### D. C. GENERATORS

| KW | Make | Type | Volts | Speed |
|---|---|---|---|---|
| 1—1200 | Al. Ch. | MHC | 525 | 750 |
| 1— 500 | G.E. | MPC | 600 | 720 |
| 1— 300 | G.E. | MPC | 250 | 525 |
| 1— 155 | G.E. | MPC | 250 | 720 |
| 1— 150 | G.E. | MPC | 125 | 200 |
| 2— 100 | Whse. | | 240 | 250 |

39th BELYEA YEAR

# BELYEA COMPANY, INC.

*Our Reputation Is Your Protection*

*Main Office and Shop*

43 HOWELL ST., JERSEY CITY 6, N. J.

Phone—Journal Square 2-3334

Also N. Y. City Line—Rector 2-7150

***Send us a list of your Surplus—We Buy for Cash***

# SINCE 1910—EQUIPMENT THAT PERFORMS!

## 1 YEAR GUARANTEE

### 125 V. - 250 V. - 550 V. D.C. GENERATORS (Motor Driven and Belted)

| KW | Make | Voltage | Ampere | Speed |
|---|---|---|---|---|
| 300 | Al. Ch. | 250/125 | 1200 | 1200 |
| 250 | G.E. | 125 | 2000 | 690 |
| 200 | G.E. | 125V | 1600 | 900 |
| 200 | Cr. Wh. | 550 | 363 | 900 |
| 150 | G.E. | 250 | 600 | 580 |
| 150 | G.E. | 125 | 1200 | 1200 |
| 150 | West | 250 | 600 | 1150 |
| 100 | G.E. | 250 | 400 | 900 |
| 100 | G.E. | 125 | 800 | 730 |
| 100 | G.E. | 125 | 800 | 1150 |
| 60 | G.E. | 125 | 480 | 900 |
| 40 | G.E. | 250 | 160 | 1150 |
| 40 | Century | 125 | 320 | 1450 |
| 40 | West. | 250/125 | 160 | 1500 |
| 40 | G.E. | 250 | 160 | 800 |
| 25 | Allen | 110 | 320 | 500 |
| 30 | G.E. | 250 | 120 | 1750 |
| 20 | Delco | 125 | 160 | 1200 |
| 20 | West (6) | 125 | 120 | 1200 |
| 20 | Col. (3) | 125 | 160 | 1750 |
| 15 | G.E. | 125 | 120 | 1750 |
| 15 | West. | 230 | 60 | 1450 |
| 15 | G.E. | 125 | 120 | 1150 |
| 15 | G.E. | 125 | 120 | 850 |
| 12½ | F.M. | 125 | 100 | 1450 |
| 10 | Rogers (2) | 125 | 80 | 1450 |
| 10 | El. Dy. | 125 | 80 | 600 |
| 8 | G.E. (2) | 125 | 64 | 1800 |
| 7½ | G.E. | 125 | 60 | 1800 |
| 5 | G.E. (2) | 125 | 40 | 1740 |
| 5 | Rel. | 250 | 20 | 1725 |

80—Additional generators—125 V. up to 200 V. generators in stock.

### LOW VOLTAGE D.C. GENERATORS

| KW | Make | Voltage | Ampere | Speed |
|---|---|---|---|---|
| 75 | G.E. | 75 | 1000 | 1145 |
| 22½ | West. | 75 | 300 | 720 |
| 90 | Century | 60 | 1600 | 1150 |
| 24 | G.E. | 60 | 400 | 1800 |
| 1-1/8 | G.E. | 60 | 19 | 1800 |
| 3 | Hertner | 60 | 60 | 1730 |
| 40 | G.E. (6) | 50 | 800 | 1160 |
| 8½ | G.E. | 42 | 205 | 1800 |
| 5 | Diehl | 40 | 125 | 1750 |
| 33 | G.E. | 33 | 1000 | 850 |
| 6½ | G.E. | 32 | 205 | 1800 |
| 3 | G.E. | 30 | 100 | 1200 |
| | West. | 30 | 1600 | 600 |
| 6 | Star (2) | 25 | 250 | 1800 |
| 5 | Star | 25 | 200 | 1750 |
| 15 | Rel. | 24 | 625 | 1450 |
| 4 | Star | 20 | 200 | 1800 |
| 106 | El. Pr. | 18 | 6000 | |
| | | 36 | 3000 | 600 |
| 1 | West. | 16 | 60 | 1750 |
| 11 | Star | 15 | 750 | 1200 |
| 1 | Cont. (2) | 15 | 67 | 1750 |
| 4½ | Star | 15 | 300 | 1800 |
| 30 | Columbia | 8-16 | 5000/2500 | 720 |
| 12 | H.V.W. | 12/14 | 1000/500 | 900 |

300—Additional low voltage generators in stock

**(3) 500 HP**
**Electric Machinery**
**Synchronous Motors**
**514 RPM**
**3 phase, 60 cycle 440 Volts**

**(1) 600 HP**
**Westinghouse Synchronous**
**Motor 900 RPM,**
**3 phase, 60 cycle, 300 Volts**

### 230 V. D. C. MOTORS

| Qu | H.P. | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 125 | West. | SK | 825 |
| 1 | 100 | West. | SK-180 | 625 |
| 1 | 100 | Rel. | | 475/635 |
| 3 | 100 | Rel. | 1050T | 400/1200 |
| 1 | 75 | West. | SK | 475 |
| 1 | 75 | Cr. Wh. | New | 480/670 |
| 3 | 60 | West. | SK-160 | 680 |
| 1 | 60 | G.E. | C | 480/1100 |
| 1 | 50 | West. | CK-9 | 525 |
| 1 | 45 | Diehl | K-10 | 850 |
| 2 | 40 | G.E. | DLC-25 | 1050 |
| 8 | 40 | G.E. | CD1441 | 250/1500 |
| 1 | 40 | Cr. Wh. | CCM | 700 |
| 1 | 35 | G.E. | RLC-204 | 440/800 |
| 1 | 35 | West. | SK-160 | 400 |
| 1 | 30 | G.E. | RC-32 | 1100 |
| 1 | 30 | West. | S-6 | 1025 |
| 1 | 30 | West. | SA | 975 |
| 2 | 30 | West. | SA | 500/1500 |
| 2 | 25 | G.E. | RC-31 | 1150 |
| 1 | 25 | West. | SK | 1100 |
| 1 | 25 | Rel. | 92T | 1150 |
| 1 | 25 | West. | SK | 800 |
| 4 | 25 | G.E. | RF-1 | 500/1500 |
| 1 | 25 | West. | SK | 500/1500 |
| 1 | 25 | G.E. | RF-11 | 500/1500 |
| 2 | 25 | G.E. | RF-14 | 300/1200 |
| 1 | 25 | G.E. | RF-14 | 300/900 |
| 1 | 25 | West. | SA | 325/975 |
| 1 | 20 | G.E. | CD-85 | 1150 |
| 1 | 20 | G.E. | RC-11 | 1150 |
| 1 | 20 | West. | SK-103 | 1200 |
| 1 | 20 | West. | S-6 | 975 |
| 2 | 20 | West. | SK-83 | 850 |
| 1 | 20 | G.E. | RC | 1800 |
| 1 | 20 | Al. Ch. | Series | 625 |
| 1 | 20 | West. | HY-6 | 700 |
| 1 | 20 | G.E. | RF-11 | 500/1500 |
| 10 | 20 | G.E. | RF-12 | 400/1200 |
| 2 | 20 | Star | SHB-20 | 29.2 |
| 2 | 16/25 | Cr. Wh. | 35-JA | 400/1200 |
| 1 | 15 | Roch. | | 3450 |
| 4 | 15 | Star | SQ-1520 | 1290 |
| 1 | 15 | G.E. | RC | 1200 |
| 1 | 15 | West. | SK-80L | 1100 |
| 1 | 15 | G.E. | RC-29 | 1150 |
| 1 | 15 | G.E. | RC-10 | 1150 |
| 1 | 15 | G.E. | CDC-85 | 900 |
| 1 | 15 | West. | SK | 850 |
| 1 | 15 | G.E. | CDE-83 | 850 |
| 2 | 15 | G.E. | RC-30 | 850 |
| 1 | 15 | West. | SK | 675/1350 |
| 1 | 15 | El. Dy. | 5S | 600/1200 |

### 230 V. D.C. MOTORS (Cont.)

| | | | | |
|---|---|---|---|---|
| 1 | 15 | G.E. | CQ | 600/1500 |
| 1 | 15 | G.E. | LC | 675/1150 |
| 2 | 15 | West. | SK-100L | 600/1500 |
| 1 | 15 | G.E. | RF-11 | 400/1600 |
| 1 | 15 | West. | SK | 250/1100 |
| 1 | 15 | Diehl | | 200/247 |
| 1 | 10 | G.E. | CD-75 | 1150 |
| 1 | 10 | G.E. | RC | 1100 |
| 1 | 10 | Triumph | TR-10S | 860 |
| 1 | 10 | G.E. | RC-29 | 850 |
| 1 | 10 | Diehl | LS-14 | 750 |
| 1 | 10 | West. | SK-7L | 700 |
| 1 | 10 | Cr. Wh. | CSM | 675 |
| 1 | 10 | West. | SK | 600/1200 |
| 2 | 10 | G.E. | RLC | 500/1500 |
| 1 | 10 | G.E. | RF-10 | 400/1600 |
| 1 | 10 | West. | SA | 400/1200 |
| 1 | 10 | G.E. | RF-10 | 400/1200 |
| 1 | 10 | Rel. | 131T | 250/1000 |
| 2 | 10 | West | Gr.Hd. | 3/10 |
| 1 | 7½ | Sturt | | 3600 |
| 1 | 7½ | L.A. | 284 | 1750 |
| 1 | 7½ | El. Dy. | 2S | 1750 |
| 5 | 7½ | Cr. Wh. | New | 1750 |
| 1 | 7½ | G.E. | RC | 1700 |
| 1 | 7½ | West. | SK | 1800 |
| 2 | 7½ | Cr. Wh. | CCM | 1425 |
| 3 | 7½ | West. | SK | 1100 |
| 1 | 7½ | G.E. | RC | 1100 |
| 1 | 7½ | G.E. | CO-1804 | 1200/3200 |
| 2 | 7½ | West. | SK-50 | 975 |
| 1 | 7½ | G.E. | RC | 900 |
| 1 | 7½ | Cr. Wh. | CCM | 875 |
| 2 | 7½ | G.E. | RC | 850 |
| 1 | 7½ | West. | SK-60 | 850 |
| 1 | 8½ | West. | SK-30 | 825 |
| 1 | 7½ | G.E. | RF-10 | 600/1500 |
| 1 | 7½ | West. | SK-90 | 650/1300 |
| 1 | 7½ | El. Dy. | 3S | 550/1650 |
| 2 | 7½ | L.A. | BW-15 | 525/1150 |
| 1 | 7½ | Roth | RS-107 | 450/900 |
| 1 | 7½ | West. | SK-70 | 400/1600 |
| 1 | 7½ | West. | SA | 400/1600 |
| 1 | 7½ | G.E. | RLC | 400/1600 |
| 1 | 7½ | Al. Ch. | | 350/1050 |
| 1 | 5 | Star | SB-5 | 1750 |
| 1 | 5 | Rel. | T-254 | 1750 |
| 2 | 5 | G.E. | RC | 1700 |
| 1 | 5 | G.E. | CDV | 1750 |
| 1 | 5 | G.E. | CVC | 1650 |
| 1 | 5 | G.E. | CD-65 | 1150 |
| 1 | 5 | Rel. | 32T | 1150 |
| 8 | 5 | G.E. | RC-27A | 1150 |
| 2 | 5 | West. | SK-43 | 1150 |
| 1 | 5 | G.E. | B-284 | 1150 |
| 1 | 5 | West. | SC-3 | 870/1750 |
| 1 | 5 | Rel. | 23T | 850/1700 |
| 1 | 5 | Al. Ch. | E-75 | 850 |
| 1 | 5 | G.E. | RC | 600 |
| 1 | 5 | Cont. | D-49 | 600/1800 |
| 1 | 5 | Star | SB-10 | 600/1200 |
| 1 | 5 | El. Dy. | 3-S | 550/1650 |
| 2 | 5 | West. | SK-60 | 500/1500 |
| 1 | 5 | Cr. Wh. | CM | 400 |
| 2 | 3 | G.E. | BD-235 | 3600 |

800—Smaller D.C. motors in stock including fractional.

### 110 V. D.C. MOTORS

| Qu. | H.P. | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 60 | Star | SQ-60L | 1200 |
| 1 | 25 | Star | 15-L | 2400 |

### 110 V. D.C. MOTORS (Cont.)

| | | | | |
|---|---|---|---|---|
| 1 | 25 | G.E. | CDM-95 | 1000 |
| 1 | 20 | G.E. | CD-83 | 1750 |
| 1 | 16 | Cr. Wh. | CMC-L | 1750 |
| 1 | 15 | West. | | 1150 |
| 1 | 15 | El. Dy. | 7½ S | 615/1230 |
| 1 | 15 | West. | S | 560 |
| 4 | 10 | Lincoln | | 3500 |
| 1 | 10 | L. A. | | 3500 |
| 1 | 10 | Al. Ch. | EBC-75 | 2175 |
| 1 | 10 | G.E. | CD-73 | 1750 |
| 1 | 10 | West. | SK-70L | 850 |
| 1 | 10 | Cont. | | 825 |
| 1 | 10 | Rel. | | 400/1600 |
| 1 | 10 | Diehl. | | 230 |

600—Smaller size 110 V. D. C. motors including fractional horsepower motors also in stock.

## NEW

Direct Current
Manual and Automatic
Starters

CUTLER - HAMMER
GENERAL ELECTRIC
WARD - LEONARD

230 Volts
164—1 H.P. Manual
24—1 H.P. Automatic
197—1½ H.P. Manual
206—2 H.P. Manual
119—2 H.P. Automatic
270—3 H.P. Manual
95—3 H.P. Automatic
33—5 H.P. Automatic
11—10 H.P. Automatic
10—20 H.P. Automatic
77—25 H.P. Automatic
4—40 H.P. Automatic
3—50 H.P. Automatic
20—60 H.P. Automatic
53—75 H.P. Automatic

115 Volts
40—1 H.P. Manual
8—1½ H.P. Manual
8—2—H.P. Manual
23—3 H.P. Manual
398—5 H.P. Automatic
1—7½ H.P. Automatic
2—60 H.P. Automatic

You must BUY!
at our prices on
these starters.

**SEND US YOUR INQUIRIES FOR A. C. EQUIPMENT**

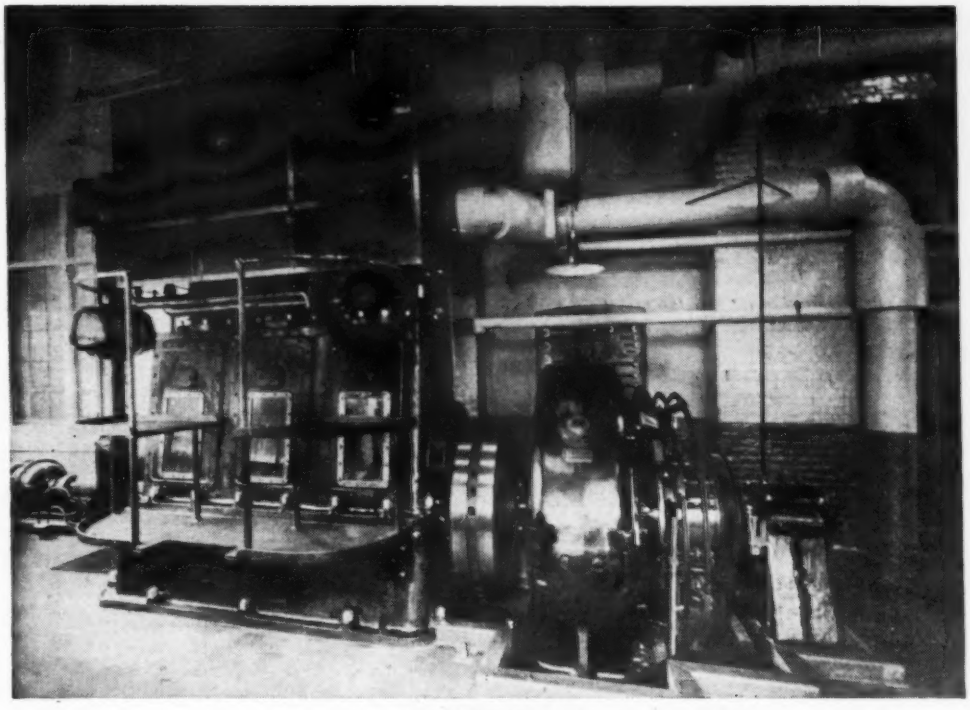
# L. J. LAND, INC.

Established 1910 — **146 GRAND STREET, NEW YORK 13, NEW YORK** — CAnal 6-6976

*New England Representative*
**BOSTON, MASS., 411 Atlantic Ave.**
***Phone:* Liberty 4300**

***Pennsylvania Office***
**READING, PA., 10th & Exeter Sts.**
***Phone:* Reading 2-6866**

# 400 KW DIRECT CURRENT SKINNER UNAFLOW ENGINE GENERATOR UNIT



400 KW maximum—325 KW, 35°C. Crocker-Wheeler 125 volt, 300 RPM interpole direct current generator direct connected to a 15" x 14", 3 cylinder, 300 RPM Skinner vertical Unaflow non-condensing engine, 125 to 150 lbs. pressure, 0 to 5 lbs. gauge back, complete with switchboard.

*Excellent Condition*

*Complete Installation*

*Actual Photograph*

## TURBINE-GENERATOR UNITS
### 3 phase, 60 cycle

**2500 KVA Westinghouse condensing,** 180 lbs. pressure, 2300 volts, 3600 RPM complete surface condenser, exciter.

**1875 KVA Westinghouse condensing,** 175 to 200 lbs. pressure, 500°TT, 480 volts, 3600 RPM, complete.

**625 KVA Westinghouse automatic bleeder condensing,** 250 lbs. pressure, 20 lbs. gauge back, 480 volts, 3600 RPM complete condenser and panel.

**625 KVA G.E. condensing,** 200 lbs. pressure, 2300 volts, 3600 RPM complete exciter, condenser, switchboard.

**625 KVA G.E. non-condensing** 150 lbs. pressure, 15 lb. back, 2300 volts, 3600 RPM complete exciter, panel.

**125 KVA Westinghouse non-condensing,** 175 to 200 lbs. pressure, 0-10 lbs. back, 240 volts, with exciter, panel.

**125 KVA G.E. non-condensing,** 175 lbs. pressure, 10 lbs. gauge back, 2300 volts, 3600 RPM complete.

**100 KVA Westinghouse non-condensing** 125 to 150 lbs. pressure, 10 lbs. gauge back, 2400/600 volts, 3600 RPM complete.

## ENGINE-GENERATOR UNITS
### Alternating Current
### 3 phase, 60 cycle

**625 KVA G.E.** 2300/550 or 440 volts, 150 RPM generator direct connected 25" x 32" Chuse non-releasing Corliss engine, complete.

**500 KVA Westinghouse,** 460 volts, 164 RPM generator direct connected to 26" x 28" Skinner Unaflow non-condensing engine, 140 to 160 lbs. pressure, 0 to 10 lbs. gauge back pressure.

**312 KVA G.E.** 480 volts, 180 RPM generator direct connected to 24" x 20" Skinner Universal Unaflow engine, 175 to 200 lbs. pressure.

**225 KVA E.M.** 2300 volts, 200 RPM generator direct connected 19" x 24" Chuse Unaflow poppet valve engine.

**200 KVA Crocker-Wheeler,** 240 volts, 400 RPM generator direct connected to Ames vertical Unaflow engine, 110 to 125 lbs. pressure, 5 lbs. gauge back.

**180 KVA G.E.** 240/440 or 550 volts, 200 RPM generator direct connected to 18" x 21" Chuse non-releasing Corliss engine, 125 to 140 lbs. pressure.

**150 KVA G.E.** 240 volts, 225 RPM generator direct connected to Ames Unaflow engine.

**75 KVA Allis** 2300/550 or 440 volts, 257 RPM generator direct connected to 12" x 16" Chuse 4-valve non-releasing Corliss engine.

## ENGINE-GENERATOR UNITS
### Direct Current

**200 KW Burke** 3-wire, 250 volt, 360 RPM generator direct connected Ames 4 cylinder vertical Unaflow non-condensing engine 150 lbs. pressure, complete switchboard.

**75 KW Allis-Chalmers Terry,** 125 volts, 2400 RPM 150 lbs. pressure non-condensing turbine generator unit.

**35 KW G. E.** 125 volt, 3600 RPM non-condensing turbine-generator unit.

**15 KW Crocker-Wheeler,** 125 volts, 410 RPM generator direct connected to an American Blower vertical engine.

## SPECIAL BARGAIN OFFERINGS

**1200 KVA General Electric,** 3 phase, 60 cycle, 2400 volts alternating current generator direct connected to 1700 HP, 3 phase, 25 cycle, 2300 volts, 300 RPM synchronous motor.

**187½ KVA Ideal** 3 phase, 60 cycle, 240 volt, 400 RPM alternator direct connected 225 HP Buckeye Diesel engine.

**156 KVA, General Electric,** type ATI, form BL, 3 phase, 60 cycle, 2300 volt, 1200 RPM alternating current generator or synchronous motor.

**500 KVA Westinghouse,** 3 phase, 60 cycle, 600 volts, 514 RPM belted generator.

**GENERAL ELECTRIC MOTOR GENERATOR SET consisting of:**

150 HP, 3 phase, 60 cycle, 2200 volts, 1200 RPM alternating current motor direct connected to 100 KW, 125 volt, compound wound interpole direct current generator.

**GENERAL ELECTRIC MOTOR GENERATOR SET consisting of:**

75 HP, 115 volt, 1200 RPM shunt wound direct current motor direct connected to 62½ KVA, 3 phase, 60 cycle, 2300 volt, 1200 RPM alternating current generator.

**MANISTEE ROTARY JET CONDENSER** 7000 lbs. steam per hour, 28" vacuum direct connected to a 25 HP, 3 phase, 60 cycle, 220 volt, 900 RPM G.E. motor.

**10 TON CAPACITY BROWN HAND OPERATED TRAVELING CRANE** with 31'0" span including 150' of I-beams.

**1—ALLIS CHALMERS SYNCHRONOUS MOTOR GENERATOR SET CONSISTING OF: 1500 KW 550/600 volts, 300 RPM compound wound interpole direct current generator direct connected to a 2190 HP, 3 phase, 60 cycle, 4000 volts, 300 RPM A.C. motor.**

Utilities Electrical Machinery Corporation
600 NATIONAL CITY BANK BLDG.
CLEVELAND 14, OHIO
WIRE OR PHONE
LONG DISTANCE 422

# GLOW

### SPECIAL—NEW PLATING GENERATORS

200 Amp., 10 to 15 volt, 1725 RPM, direct current, Master Plating Generators with overhung exciter.

### MOTOR DRIVEN CENTRIFUGAL PUMP

**Dayton Dowd, size 6x18 CSLF, rated 7250 G.P.M. 30 ft. head, at 685 RPM Centrifugal Pump mounted on common base and driven by:— Continental 75 HP. 695 RPM, 220 volt, 3 phase, 60 cycle, drip proof motor.**

### COPPER OXIDE PLATING RECTIFIERS

500 Amp., 6 volts, Direct Current, for 440 volt, 3 phase, 60 cycle power, General Electric, Model 6RC120F2.

*Note: Designed to be operated in series or parallel for higher voltage or current.*

### A. C. GENERATORS

(3 phase unless otherwise noted)

| KW | P.F. | RPM | Volts | Description |
|---|---|---|---|---|
| 3 | 1 | 1900 | 120 | Hobart, Ball Bearing |
| 4 | 1 | 1170 | 440 | Westinghouse, Single Phase |
| 7½ | .6 | 1800 | 440 | Electric Specialty, Ball Bearing |
| 15 | 1 | 1800 | 127/220 | General Electric, Single Bearing |
| 20 | .8 | 1800 | 1100 | Fairbanks-Morse |
| 20 | 1 | 1800 | 110 | Ft. Wayne, Single Phase |
| 25 | .8 | 1200 | 208 '120 | Westinghouse, Ball Bearing, New |
| 30 | .8 | 1200 | 120/208 | Delco |
| 40 | 8 | 1200 | 220 | Burke, Single Bearing |
| 50 | .8 | 1200 | 120/208 | Electric Machinery, Single Bearing, 4 Wire |
| 37½ | .8 | 900 | 110/220 | Starr, Single Phase |
| 100 | .8 | 900 | 200 | Crocker-Wheeler |
| 100 | 1 | 900 | 2300 | General Electric |
| 120 | .8 | 257 | 2300 | General Electric, Single Bearing |
| 150 | 1 | 600 | 480 | Burke |
| 150 | .8 | 900 | 600 | General Electric |
| 150 | .8 | 600 | 480 | Crocker-Wheele |

### PLATING GENERATORS

Jantz & Leist, type IP, 4000 ampere, 2 to 12 volts, 425 RPM, direct current Plating Generators with or without driving motors.

### GAS ENGINE—AC GENERATOR SETS

2½ KW Leland, type A, frame 50, 1800 RPM, 120 volt, single phase, 60 cycle, AC Generator, with Briggs & Stratton, Model ZZ, 6 HP, 1800 RPM Gasoline Engine, U. S. Army PE75AA, complete with gas tank and tool box.

5 KVA Onan, .8 P.F., 1800 RPM, 110/220 volt, single phase, 60 cycle, AC Generator with Onan, twin, 4 cylinder Gasoline Engine complete with starting panel.

7½ KVA, 120 volt, 3 phase, 60 cycle, AC Generator with 4 cylinder Wisconsin Engine, U. S. Army PE99, type VE4-1, size 3 x 3¼, complete with switchboard panel.

10 KVA, 110/220 volt, single phase, 3 wire, 60 cycle, Westinghouse, AC Generator with water cooled Jeep Engine Drive, U. S. Army PE95, 4 cylinder. Complete with switchboard panel.

25 KVA Westinghouse, 20 KW, .8 P.F., 900 RPM, 120 volt, 1 phase, 60 cycle, AC Generator, with LeRoy Gas Engine complete with control panel.

31.25 KVA, 25 KW Westinghouse, .8 P.F., 1200 RPM, 208/120 volts, 3 phase, 60 cycle, AC Generator with LeRoy Gas Engine complete with control panel.

*Note: In addition to the above Engine Generator Sets, our stock includes practically all sizes up to 35 KVA both AC and DC, some with Diesel Engine Drive.*

### NEW DIRECT CURRENT MOTORS

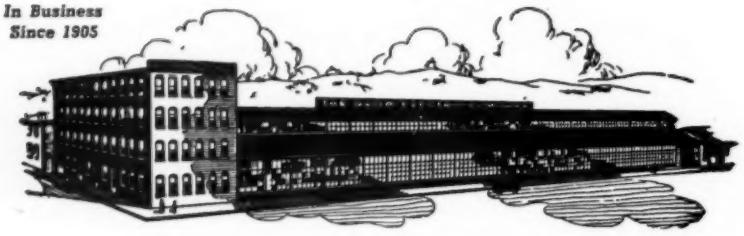
25 HP, 1750 RPM, 230 volt, compound wound, Marble-Card motors, Marine type, drip proof.

### MOTOR GENERATOR SETS

| KW | Volts | Generator Mfgr | A. C. Motor |
|---|---|---|---|
| *600 | 250 | General Electric | 900 HP, 1200 RPM, General Electric, Synchronous |
| *300 | 250 | General Electric | 450 HP, 1200 RPM, General Electric, Synchronous |
| 200 | 125 | General Electric | 300 HP, 900 RPM, General Electric, Synchronous |
| 50 | 120/125 | Burke | 95 HP, 1200 RPM, Burke, Synchronous |
| *50 | 115/230 | Westinghouse | 75 HP, 1800 RPM, Westinghouse, Induction |
| 40 | 250 | Reliance | 60 HP, 1800 RPM, Century, Induction |
| 25 | 125 | General Electric | 35 HP, 1200 RPM, General Electric, Induction |

* These Motor Generator Sets are new.

*In Business Since 1905*



## ELECTRIC CO.

### Late Type TURBO-GENERATOR SET

Westinghouse 300 KW, 1200 RPM, 120/240 volt, compound wound, D.C. Generator with interpoles, directly connected to:

Joshua Hendy Steam Turbine, 5965 RPM, for steam conditions of 440 lbs. per sq. inch gauge inlet pressure 28½" vacuum, 740 deg. F. total temperature. Including speed reducer, rheostat and balancer coil.

### DYNAMOMETERS

General Electric, 50 HP, 700/2500 RPM, 250 volt, 21.008 inch torque arm. Can absorb up to 60 HP motor.

### DIRECT CURRENT GENERATORS

| KW | Volts | RPM | Manufacturer | Description |
|---|---|---|---|---|
| 400 | 120/240 | 300 | Westinghouse | Compound, Interpole, Pedestal Bearings |
| 290 | 250 | 900 | General Electric | Single Bearing |
| 250 | 120/240 | 1200 | Crocker-Wheeler | Compound Wound |
| 200 | 125 | 900 | General Electric | Compound Wound |
| 200 | 250 | 1200 | General Electric | Single Bearing, Compound Wound |
| 200 | 250 | 375 | Jantz & Leist | Compound Wound, Pedestal Bearings |
| 175 | 250 | 450 | Westinghouse | Compound Wound, Pedestal Bearings |
| 150 | 250 | 900 | General Electric | Single Bearing |
| 100 | 240/325 | 1200 | Elliott | Single Bearing |
| 100 | 125 | 1200 | Western Electric | Compound Wound |
| 100 | 125 | 900 | Crocker-Wheeler | Compound Wound, Pedestal bearings |
| 80 | 125 | 500 | Jantz & Leist | Compound Wound, Double Shaft Extension |
| 80 | 125 | 400 | Jantz & Leist | Compound Wound, Double Shaft Extension |
| 30 | 250 | 300 | Triumph | Compound Wound |
| 22½ | 250 | 765 | Westinghouse | Compound Wound |

**AC & DC MOTORS • GENERATORS • PUMPS**
**SYNCHRONOUS MOTORS • CONTROL EQUIPMENT**
**MOTOR GENERATOR SETS • ELECTRIC HOISTS**
**STEAM ENGINE GEN. SETS • SLIP RING MOTORS**

**933-943 HARRIET ST.**
**PHONE MA. 3024**
**CINCINNATI 3, OHIO**

# AVAILABLE FOR IMMEDIATE SHIPMENT

## UNIFLOW ENG. GEN. SET

1—300 kw Chuse vertical Uniflow engine generator set 6 cyl. 10 x 12 150# pressure O# B.P. 450 RPM direct connected to 300 kw G.E. Alternator 3-60-2300 v. with D.C. exciter 125 v. Excellent condition. Rebuilt 1945. Reasonably priced for quick sale.

## SKINNER UNIFLOW SET

1—300 KVA Skinner Uniflow Engine Generator Set 150# ISP 0-5# BP direct connected to Burke Alternator 3-60-480 v. 200 RPM with Exciter and Control Panel.

## TURBINE

1—710 H.P. Terry Turbine, type GF, 3531 RPM, complete with reduction gear to 1000 RPM, 145# pressure, 0-60# B.P.

## TURBO PUMP

1—520 GPM, 50' head, DeLaval Centrifugal Pump, 2940 RPM, direct coupled to DeLaval Turbine, 200# pressure, 0-5# B. P.

## PUMPS

3—400 GPM, 635' head, Ingersoll Rand direct connected to West. 125 HP motor, 3-60-2200 v. 3600 RPM.

2—500 GPM, 360' head, Ingersoll Rand Centrifugal Pump, 1800 RPM.

1—4500 GPM, 135' head, LeCourtney Centrifugal Pump, 1800 RPM.

1—1000 GPM, 250' head, Ingersoll Rand Centrifugal Pump, 1800 RPM.

1—1200 GPM, 35' head, American Well Works Centrifugal, 1750 RPM direct connected to 15 HP motor 3-60-220/440 v.

2—520 GPM, 50' head, DeLaval Centrifugal Pump, 1150 RPM.

5—Worthington, 2⅜" x 18" Horizontal Duplex Double Acting, cap. 133 GPM, 3500 W.P.

## CARRIER AIR CONDITIONING UNIT

1—30 ton Carrier Air Conditioning Unit consisting of two—2 cylinder Compressors and two—15 HP Motors mounted on common base; with Kathabar Unit complete with all accessories, starters and instruments. Electrical characteristics 3-60-220-440. New 1942. Has been in use one season.

## FLANGED GATE VALVES

Stainless Steel. Sizes 1" to 6".
Iron Body. Sizes 2" to 14".
Cast Steel. Sizes 2½" to 16".

## NEW HOISTS

150 Yale & Towne 2 ton Chain Hoists. 20' lift.
BRAND NEW in Original Packing.

## MOTORS

1—300 HP Westinghouse Type CS, 2200 Volt, 3 phase, 60 cycle, 600 RPM.

1—200 H.P. G.E. Synchronous Motor 3/60/4150, 600 RPM with starting panel, V-Belted exciter. New 1943.

1—125 H.P. West. Squirrel Cage, 3-60-2200 v., 1800 RPM and Starter.

1—40 H.P. General Electric Squirrel Cage, 3-60-440 v., 870 RPM, 40° C Rise, type K 342, Form B.

1—20 H.P. General Electric Induction Motor, 3-60-220 v.

7—Vertical Gear Head Motors, Crocker Wheeler TFFC 10 HP, 220/440 Volt, 60 cycle, 3 phase, 1745 RPM, Philadelphia Gear, output 425 RPM.

## TRANSFORMERS

3—20 KVA New, single ph., 450-117 v.
6—25 KVA New, single ph., 450-117 v.
1—540 KVA OISC, 3 ph. 680-82 v.
1—100 KVA 3 ph. 4370-4160-3950/208-120 v.
1—7½ KVA single ph., 480-230-115 v.

## 300 AND 400 AMPERE ELECTRIC MOTOR DRIVEN ARC WELDERS

*Lincoln—Hobart—General Electric*
Reconditioned—Guaranteed—New 1943

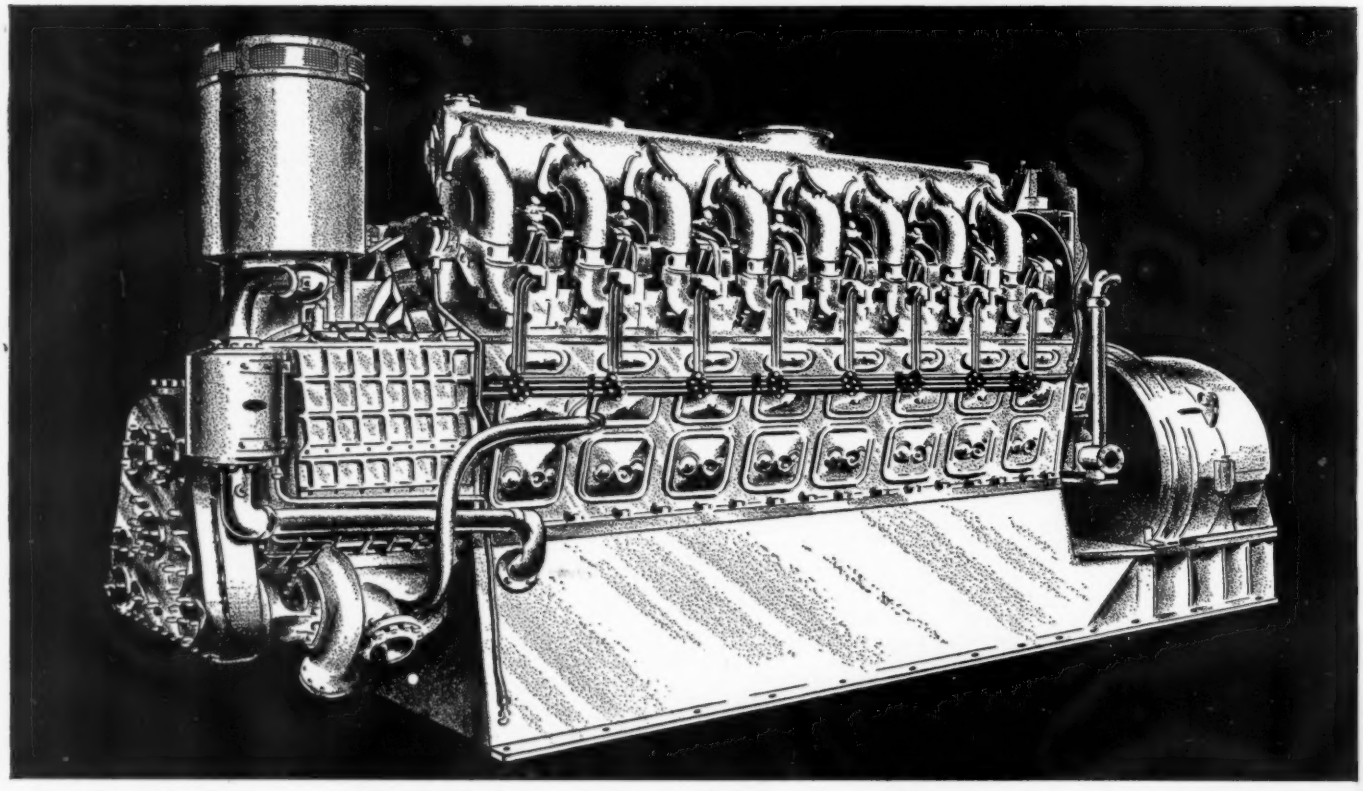
## MISCELLANEOUS

1—Accumulator, Watson Stillman, 42" diam. Air Cylinder, 11½" diam., Ram, 50" stroke, 3500 Lb. W.P.
1—3600 sq. ft. CR. Wheeler Surface Condenser.
10—Buffalo Steel Plate Blowers, 40", type R, with Everdur Blades.

**Heat and Power Co., inc.**

70 PINE STREET | WHITEHALL 3-2172 | NEW YORK 5, N. Y.

# DEPENDABLE POWER.



## 1000 KW G.M. DIESELS

**1600 HP GENERAL MOTORS MODEL 16-278A ENGINES**
**16 CYLINDER—2 CYCLE—720·750 RPM DIRECT CONNECTED TO 50–60 CYCLE AC OR 525 VOLT DC GENERATORS**

## 2–2000 HP FAIRBANKS MORSE

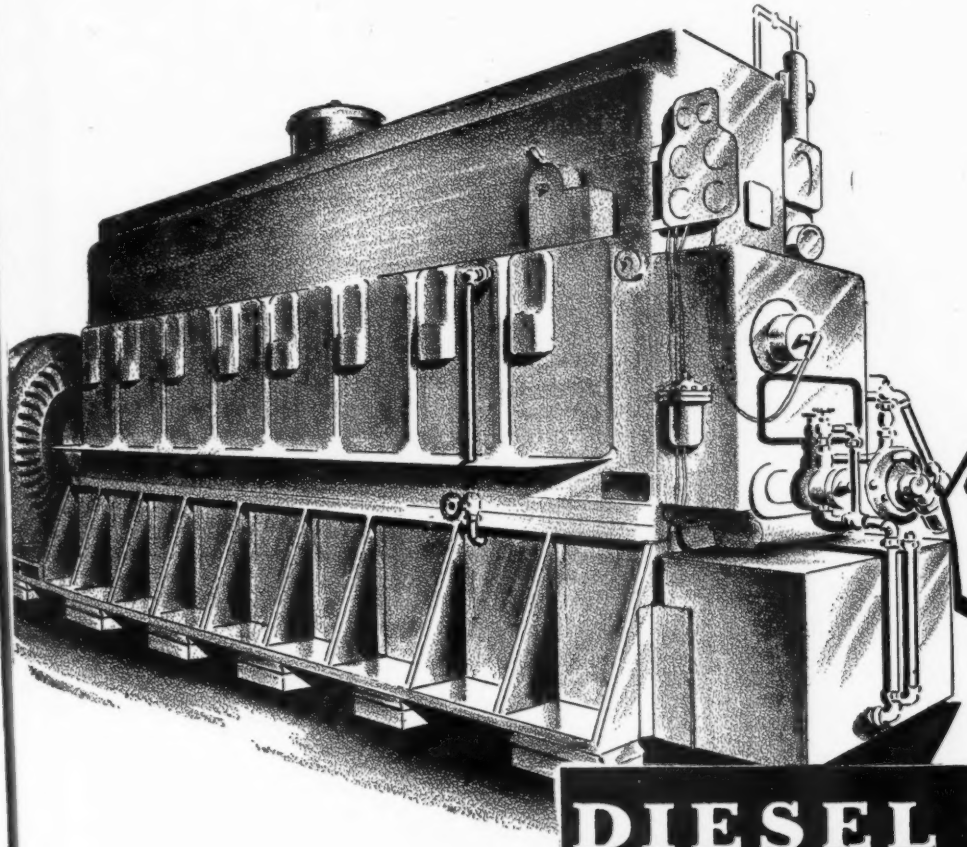
**LATEST MODEL 33 • COMPLETE GENERATOR PLANTS 1875 KVA**

### Other Important Units

| HP | Model | KVA | RPM | New | HP | Model | KVA | RPM | New |
|---|---|---|---|---|---|---|---|---|---|
| 1—840 | Fairbanks Morse M | 565 | 257 | 99% | 1—375 | McIntosh Seymour | 350 | 360 | 85% |
| 2—720 | Fairbanks Morse M | 465 | 257 | 95% | 1—365 | Ingersoll Rand S | 340 | 600 | 95% |
| 2—600 | Fairbanks Morse 33F | 500 | 400 | 99% | 3—165 | Murphy ME 650 | 145 | 1200 | 95% |
| 2—450 | Fairbanks Morse 33E | 375 | 360 | 95% | 3—125 | General Motors 6-71 | 75 | 1200 | 100% |
| 1—360 | Fairbanks Morse YVA | 300 | 257 | 80% | 4—100 | International UD18 | 62.5 | 1200 | 100% |
| 2—240 | Fairbanks Morse YVA | 200 | 257 | 85% | 1— 90 | Cummins HIS-600 | 62.5 | 1200 | 100% |
| 1—180 | Fairbanks Morse YVA | 150 | 257 | 95% | 2— 90 | Buda | 75 | 1200 | 90% |
| 1— 80 | Fairbanks Morse YVA | 65 | 300 | 85% | 20— 65 | International UD14 | 37.5 | 1200 | 100% |
| 20— 35 | International UD6 | 18.7 | 1200 | 100% | 6— 52 | General Motors 371 | 37.5 | 1200 | 100% |

# ..at low cost

## NEW BUCKEYE DIESELS



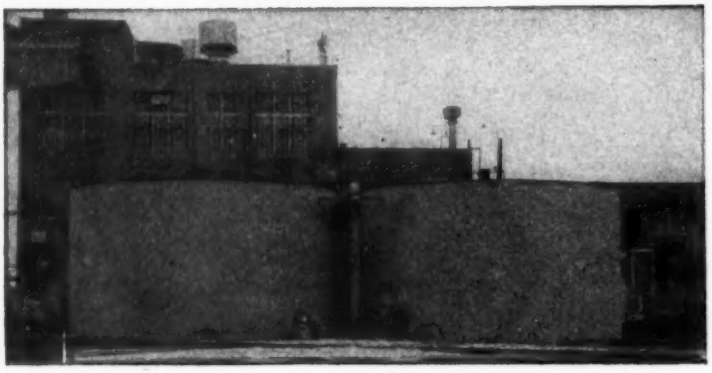
225-300-450 HP
MODEL 80
4-5-8 CYLINDER 10½ x 12
4 CYCLE • 600 RPM

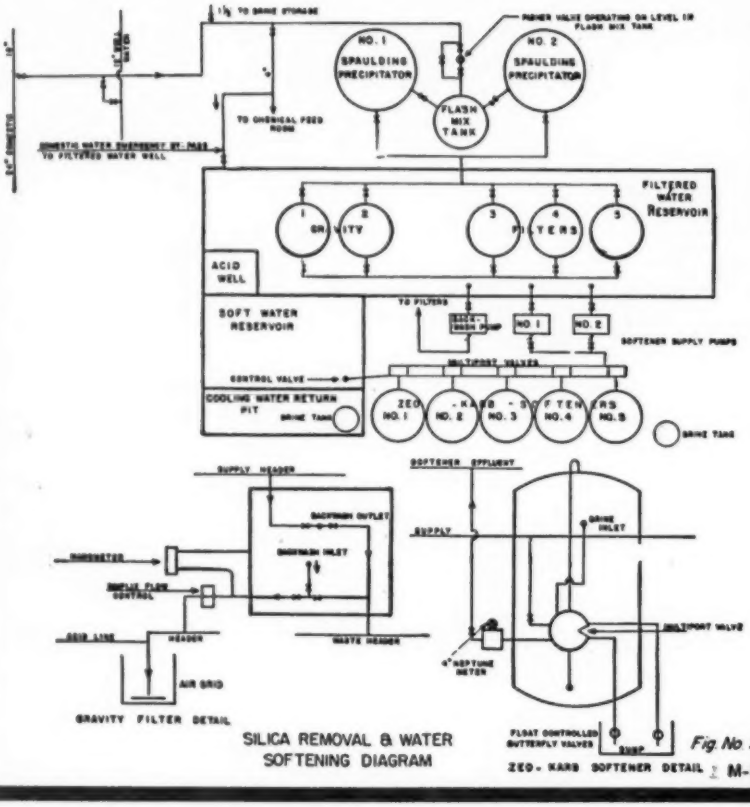
ALSO COMPLETE
GENERATOR PLANTS
150-200-300 KW

IMMEDIATE DELIVERY!

DIESEL MOTORS CORPORATION

PORT WASHINGTON, L. I., N. Y.
TEL. PORT WASHINGTON 2000






# WATER TREATMENT PLANT

★

*Modern*

★

# AVAILABLE NOW

★

**Designed for 1560 GPM with water of 11 grains, total hardness calculated as $CACO_3$.**

**Used for boiler plant**

**—Boiler feed requirements..1080 GPM**
**—Boiler blowoff waste..... 144 GPM**
**—Precipitator, etc., waste.. 336 GPM**

**1560 GPM**

**Each softener to remove 2035 Kilograins of hardness between regenerations with water of 11 grains total hardness.**

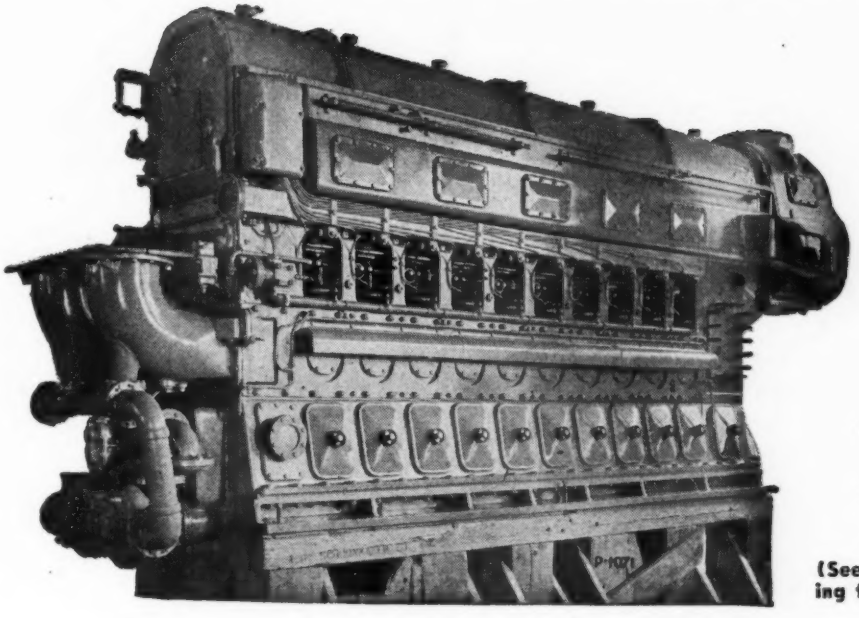
## *Including:*

(A) Bailey indicating, integrating, and recording meter
(B) 10" Fisher pilotoperated flood valve
(C) 11' x 22' steel mixtank, motor driven agitator
(D) Ferrisul feed, electro-chemical control; two 5' x 5' lead lined steel tanks with agitators; 10' x 6' rubber lined feed tank and agitator, with pumps
(E) Spare electro-chemical control unit
(F) Lime feed, 10' x 6' chemical feed tank with agitator, pumps, electro-chemical control
(G) Dissolving line tank 10' x 6' with agitator
(H) Two 39' x 22' high all steel Spaulding Precipitators with agitators
(I) Two Leeds & Northrup pH recorders
(J) Five gravity filters, 1575 GPM total, 315 GPM each—13' x 12' high, including graded anthrafilt
(K) Constant rate acid feed with Leeds & Northrup pH recorder and control, 2' x 2' lead lined acid tank, 7' x 5' high lead lined solution tank, orifice tanks, pumps, agitator
(L) Five sodium Zeo-Karb softeners 8' x 12' high with salt measuring tanks
(M) With miscellaneous pumps, motors, piping, chemicals, etc.

## THOMAS ROME & ASSOCIATES, INC.

**307 EAST FOURTH STREET** **CINCINNATI 2, OHIO**

ENGINEERED AGSCO DIESEL POWER



## 3000 KVA PLANT CONSISTING OF:

3—1000 KVA, 800 KW, 3 phase 60 cycle, 2300 volt. Westinghouse, 600 RPM, Direct Connected to:

3—1250 H.P. Fairbanks-Morse Diesel Engines, Model 38D8⅛, 10 cylinder, 8⅛" bore 10" stroke, 600 RPM.

(See photo at left of similar unit prior to loading from our plant #1 Jersey City.)

These three units are offered with complete equipment—switchboards, auxiliaries cooling equipment and silencing equipment.

# DIESEL GENERATORS

## ALTERNATING CURRENT

### (60 and 50 cycles)

| KVA | MAKE | HP | MODEL | RPM | YEAR |
|---|---|---|---|---|---|
| 2—1875 | Fairbanks Morse | 2000 | 33E16 | 300 | 1939 |
| 1—1250 | Nelseco | 1500 | 6M1-53 | 300 | 1931 |
| 8—1250 | Fairbanks Morse | 1700 | 38D8⅛ | 720 | 1944 |
| 12—1250 | General Motors | 1600 | 16-278-A | 720 | 1944 |
| 3—1000 | Fairbanks Morse | 1250 | 38D⅛ | 600 | 1944 |
| 1— 625 | Superior | 750 | OS | 327 | 1938 |
| 1— 312 | Enterprise | 450 | D8G-8 | 450 | New |
| 1— 300 | Fairbanks Morse | 360 | YVA | 257 | 1928 |
| 1— 250 | General Motors | 300 | 8-268-A | 900 | New |
| 4— 250 | General Motors | 400 | 8-268-A | 1200 | 1945 |
| 6— 125 | General Motors | 200 | 8-268-A | 1200 | 1944 |
| 3— 94 | General Motors | 125 | 6061 | 1800 | New |
| 1— 94 | Buckeye | 112 | E | 400 | 1936 |
| 4— 75 | General Motors | 90 | 6061E | 1200 | New |
| 13— 62 | International | 75 | UD18 | 1200 | New |
| 8— 37 | General Motors | 45 | 3-71 | 1200 | New |
| 15— 18 | International | 30 | UD6 | 1200 | New |

*What are your requirements?*

Write for Bulletins

DIESEL ENGINES

AG SCHOONMAKER CO INC.

50 CHURCH STREET NEW YORK 7, NEW YORK

Cable Address: AGSCOMACH PHONE: WOrth 2-7225

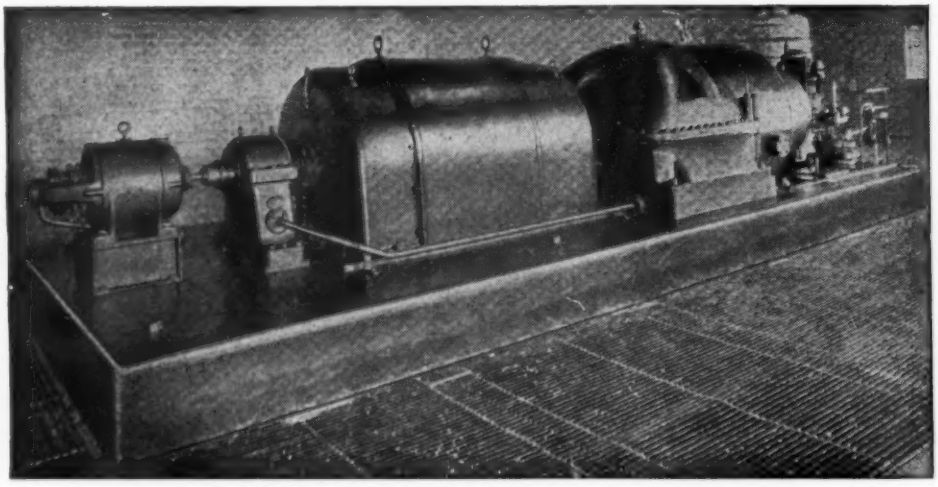
Business Est. 1898

DIESEL POWER

# TURBO-GENERATORS

IMMEDIATE DELIVERY

SEND FOR BULLETIN 259



SEND FOR BULLETIN 259

1875-KVA ELLIOTT SURFACE CONDENSER: 300#-PSI., 550-FTT. 2300-V

**Turbo-Generators - July-August - Stock List**

**Partial List Only**

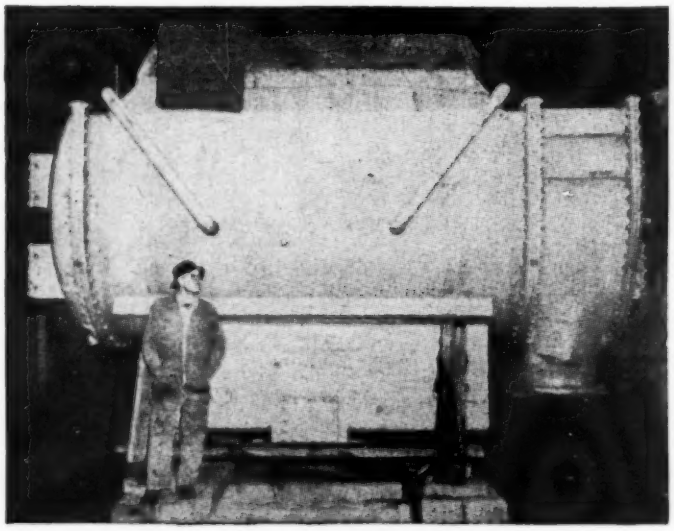
7800-KVA. G.E. 250#, 2300-V., Sur. Condenser
5000-KVA. G.E. 200#, 100-Deg., 2300-V.
3750-KVA. G.E. 200#, 2300-V., Condensing
3125-KVA. West., 200#, 2300-V., (1-GE.)
2500-KVA. G.E., Aut. Extr., 200#-psi., 25#-B., 480-V.
1865-KVA. Elliott, 350#, 550-F.TT., 2300-V.
1865-KVA. G.E., Cond., 200#, 2300-V.
1865-KVA. G.E., Aut. Extr., 200#, 30#-Back, 2300-V.
1250-KVA. Allis-C., Non-Cond. 160#, 25-Back, 2300/4000-V.
937-KVA. Terry-Allis, Non-Cond., 200#, 85#-Back, 2300-V.
937-KVA. Moore-Allis, Non-Cond., 200#, 25#-Back, 2300-V.
937 KVA. Allis-Chalmers Cond., 200#, 480-V.
625-KVA. West., Aut. Extr., 250#, 25#-Back, 480-V.
625-KVA. G.E., Non-Cond., 200#, 25#-Back, 2300-V.
500-KW., Several Good Units Available

**SPECIAL**

**6—Brand New Westinghouse, 300 KW. Turbine-Generators, DC., 3-wire, 250-V., 450# Psi., 750° TT.**

## 5 - NEW CONDENSERS IN STOCK

**3-8280 and 2-6300-sq. ft., Surface Type**
**Both Top Center Openings**



**IN STOCK NEW Steam Air Ejectors • Condensate Pumps • Circulating Water Pumps**

ALSO SPECIALISTS IN: DIESEL ENGINES, BOILERS, GENERAL POWER PLANT EQUIPMENT. We OWN Outright all machines which we offer. Please use Bulletin Nos.

*Correspondence Invited*

## CHARLES WEAVER & COMPANY

**4045 Penobscot Building** **Detroit 26, Michigan**

## 2500 KW EXTRACTION-CONDENSING UNIT

480 volt, 3 ph. 60 cycle. Built for 175/185# 525° f.t.t. Extraction 58,000#/Hr. max. at 5# g. (1920) Turbine now being rebuilt; will arrange for extraction at 30# g. if required. Includes 35 KW MG exciter set—all switchgear, accessories, and auxiliaries.

## 1500 KW G.E. CONDENSING UNIT

1500 KW G. E.-Lynn Type Condensing Unit S/N 22500. 60/3/480 v. 150# 450° W.R. 15.2# approx. Can rebuild for 300# 600° 22# g. 30,000 hr. extraction. Generator rewound 1943—all auxiliaries including 1650 ft. condenser. All in excellent condition.

## 90,000#/Hr. 250 PSI B&W integral FURNACE BOILER—

GAS and OIL fired. Never installed—can ship and install on short notice—all auxiliaries complete.

## FURNACE TRANSFORMERS

Two units 4000 KVA 60 cyc. 3$\phi$ 13,200 primary 239/85 secondary, oil insulated water cooled, with controls. New about 1940.
Two units 3000 KVA same specifications and age as above.
One unit 2000 KVA same specifications and age as above
One 1500 KVA 3$\phi$ 12,000 primary; 3600 KVA Bank 13,200 primary.
Two units 4000 KVA 60 cyc. 3$\phi$ 22,000 primary, 228 secondary, with reactors—New 1943—with controls.
One 200 KVA 60 cyc. 3$\phi$ primary 307/153 secondary 120/60 New.
Also other units.

## VERY GOOD EXTRACTION-CONDENSING MACHINE—CAN SHIP QUICK

1000 KW—0.8 p.f.—250# 550° 25# ga. extraction, 40,000#/hr. 60/3/480 11 stage turbine—double bucketed in high—13.5#/KWH condensing W.R.—direct connected exciter—surface condenser switchgear—Built 1929—mate duplicate installation—regular maintenance and renewals.

## TRANSFORMER (OUTDOOR)

10,000 KVA 3$\phi$ 60 cyc. OISC, 13,200 delta/4600 delta 4 taps 2½% below primary. Cannot be reconnected to other voltage.

## STRAIGHT—CONDENSING TURBO SET 450# 650° WESTINGHOUSE

1500 KW—0.8 p.f.—60/3/240—built 1928—surface condenser all auxiliaries—reported excellent physical condition.

Mate unit installation. Two 1000 KW Elliott Turbo Generators, 1000 KW 200# 600° F. T.T. 60/3/480 straight condensing. Surface condensers—exciters—pumps—10 T. crane. Excellent condition. Units adaptable to 60# ga. extraction.

600 KW G. E. Condensing 60/3/600—150# isp—20.5# W. R. Surface condenser—all auxiliaries—Serial #20,000.

1000 KW G. E. Condensing 60/3/600—250# isp. Surface condenser—all auxiliaries including spray pond—Turbine Serial #27,600. Excellent condition.

## TURBO ALTERNATORS

**Condensing**
1000 KW (3 units) 2400 V 150# 100° Jet Cond (new about 1922)
1250 KW 2400 V 200# 100° Surf Cond (new 1924)
1500 KW 480 V 200# 100° Jet Cond (new 1920)

**Non-Condensing**
100 KW 240 V 175# 100° ISP 0 to 5# g. BP (new 1921)
1500 KW 2400 V 175# 100° ISP 10# g. BP (new 1926) rebuilt
1500 KW 240 V 400# 650° ISP 90# g. BP (new 1928)
1000 KW 60/3/2400 200# ISP 5/10# g. BP Allis about 1920.
2000 KW 60/3/480 200# ISP 20# g. BP G.E. about 1921.

## DC TURBO UNITS

1000 KW 250 V 150# Surface Condenser
750 KW 250 V 16#/165# (M.P.) Jet Condenser
150 KW (2 units) 250 V 225# 25# g. BP modern design

## BOILERS

**Water Tube**
600 HP (2 units) 160# pulverized firing—sect'l hdr. Pennsylvania
400 HP 400# 650" sect'l hdr (new 1928)
519 HP Heine Boiler—CAN SHIP INTACT. MOST MIDWEST POINTS—NOT NECESSARY REMOVE OR REPLACE TUBES. Built 1928 for 180# and now approved 180# Coxe chain grate stoker equipped.
30,000#/hr. B&W Integral Furnace Type, 425#, pulverized coal fired.
40,000#/hr. 350# 100° S.H. C. E. integral furnace type, Type E stoker.

And a few modern 450-500-700 psi Generating Units

## DIRECT CURRENT UNITS

340 KW (two units) 250 V. Nordberg 3 cyl. 2 cyc.
525 H.P. @ 257 RPM—Elliott Generator
Each unit complete. BUILT 1943. (Price is reasonable)

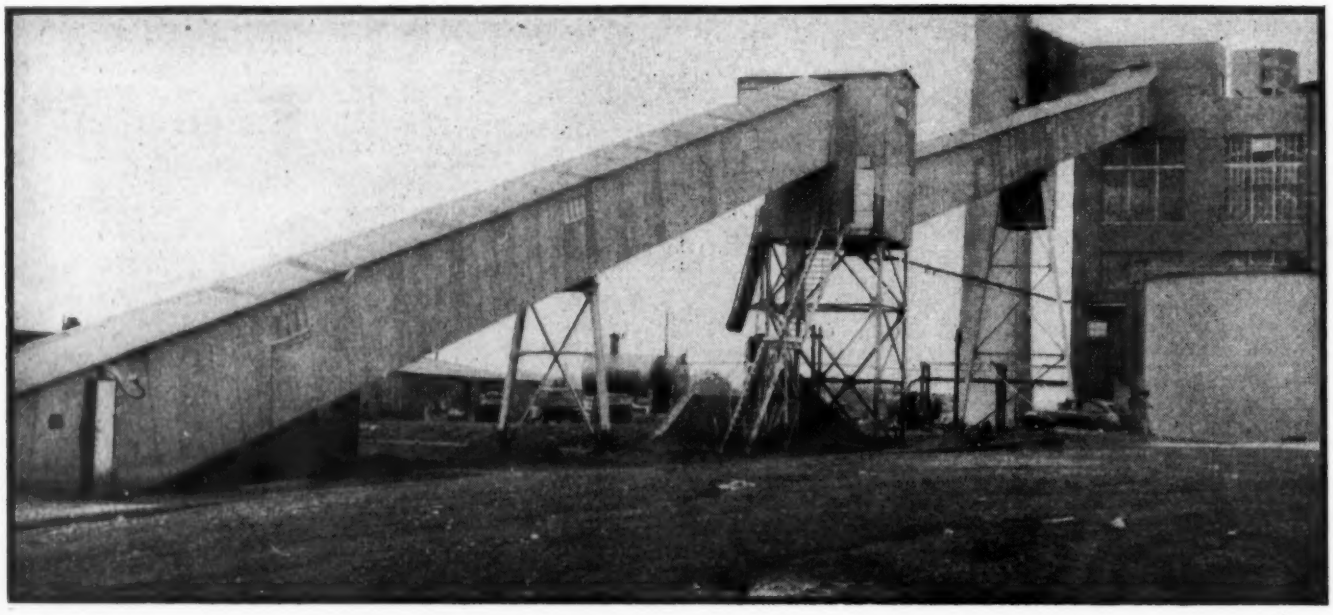
**SPECIAL** 250,000#/Hr. 450# pulverized coal fired steam generator—complete and in good condition.

# PAUL STEWART & CO., INC.

**UNION TRUST BUILDING . . CINCINNATI 2, OHIO**

*Over 50 Years of Service*

# *Complete* { COAL HANDLING / COAL STORAGE } *System*



**100 Ton/Hr. Link Belt Conveyor—Grinders—Scrapers, etc., for 20,000 Ton Storage. All supporting steel—motors—screens—belts—complete**

(A) Track hoppers with girders for two track siding

(B) 2-Apron feeder conveyors 30' and 20' from hopper pit

(C) Dragline (scraper) coal storage system about 200' x 150' with winder, scraper, controls

(D) Drag operators house with crusher housing, all steel—crushers, controls, etc.

(E) Conveyor section #1, 20" troughing conveyor, from crusher pit to junction tower, 182' at 16° incline from elevation minus 10' to plus 36', steel housing and walkway

(F) Junction tower 12' x 18' x 46' high with controls, etc.

(G) Conveyor section #2, 20" troughing conveyor, from junction house to boiler house. 185' at 12° from elevation 26' to 67', steel housing and walkway

(H) Conveyor section #3, 20" troughing conveyor, over bunkers about 185', 24" diameter heavy duty magnetic head pulley

(I) Automatic self-propelled self-reversing belt tripper
105 carrying idlers—3 pulley troughing type 5" diameter on 5' centers
53 return idlers 5" diameter on 10' centers

## THOMAS ROME & ASSOCIATES, INC.

**307 EAST FOURTH STREET** **CINCINNATI 2, OHIO**

# LIQUIDATION SALE

## (MOST EQUIPMENT 3 TO 4 YEARS OLD)

### DIESEL ENGINES

2—300 HP Fairbanks Morse Model 38 O.P. 6 cyl. 2 cycle 5"x6" 1200 RPM (built 1936)

2—350 H.P. Superior Diesel Ser #10501 & 10529, Type VD. MB, 8 cyl., Bore 9", Stroke 12", 600 R.P.M., built 1939

4—1800 H.P. General Motors 16-258S, 16 cylinder, 9½" x 12", 4 cycle, Buchi supercharged 900-750 RPM (new 1943)

2—1800 H.P. (HOR) Hamilton 9 cylinder, 2 cycle, 800 RPM, reversible (new 1944)

2—500 H.P. General Motors 8-268A, 8 cyl., 6½" x 7", 2 cycle, 1200 RPM (new 1943)

The above engines can also be supplied with fluid couplings, reduction gears and all other equipment suitable for ship installation.

### DIESEL GENERATORS

4—1200 KW, D.C., Allis Chalmers, 525 V. 750 RPM Driven 1700 HP General Motors Diesel 16-278A 750 RPM (New 1943)

1—200 KW, AC, 3/60/440 and 40 KW, DC, 120/240 V Driven by 500 HP General Motors Diesel, 8-268A, 8 cyl., 6½" x 7" 2 cycle, 1200 RPM (new 1943)

3—60 KW, DC, 120 V driven by 90 H.P. General Motors Diesel 6-71, 6 cylinder, 4½" x 5" 1200 RPM. New 1943

1—60 KW, DC, Generator, 250 V. driven by 110 H.P. Buda Diesel, 8 cylinder, 4 cycle. New 1944

All auxiliary equipment can be furnished.

### MOTORS

5—DC 25 HP, 35 HP, 50 HP, type CO 1808, 230 V, all variable speed 550 RPM to 2100 RPM

500—DC, from ½ HP to 60 HP, 120 V, various speeds

**18—General Electric AC synchr. motors, 3 phase, 6000 HP, 93 1/3 cycle, 2700 V, 400 RPM, or 3800 HP, 60 cycle, 1700 V, 257 RPM**

**28—DC 1500 HP, W'hse, 525 V, 600 RPM**

### HOISTS

6—Mead Morrison Co., 2 drum hoisting engines type H197, driven by 51 HP G.E. motor 230 V, DC

5—Mead Morrison Co., single drum derrick swingers type 138, driven by 5 HP G.E. motor 230 V, DC

NOTE: The above hoists are complete with controllers

2—Jaeger Utility hoists, single drum, driven by Continental 6 cylinder gasoline engine.

### TURBO-GENERATORS

**6—4600 KW G.E. 3 phase, 93 1/3 cycle, 2700 V, 5600 RPM (or 2900 KW, 60 cycle, 1700 V, at 3600 RPM), 410# cond., complete with 3800 sq. ft. condensers, amplidyne motor generators, circulating and condensate pumps, etc.**

**6—300 KW G.E. type ATI 3/60/450, 1200 RPM, cond., compl. with 40 KW exciters, condensers, switchboards.**

8—200 KW G.E type ATB 3/60/450, 1200 RPM, cond.

2—132 KW G.E. type ATB 3/60/450, 1200 RPM, cond.

2—375 KW West'hse 180/220 V, DC, 3000 Amp, 1200 RPM, cond.

1—300 KW 120/240 V. D.C. 1200 RPM

12—150 KW West'hse type SK, 120 V, DC, 1200 RPM, cond.

20—60 KW West'hse type SK, 120 V, DC, 1800 RPM, cond.

NOTE—MANY GENERATORS FOR SALE SEPARATELY WITHOUT TURBINES

### MOTOR—GENERATORS

AC to DC and DC to AC—various sizes from 1 HP to 80 HP.

**GENERATORS**

**28—1200 KW DC Allis Chalmers, 525 V, 750 RPM**

### TURBO-BLOWERS

9—Sturtevant size 24—20,000 CFM at 17" S.P. turbine, 191 HP, 400# steam

### CONDENSERS

4—7800 Square Feet—¾" brass tubes, two pas. (new).

10—3800 Square Feet ⅝" copper-nickel tubes (new).

### SWITCHBOARDS

All sizes, AC and DC, whole or in parts, circuit breakers, current transformers, switches, meters, recorders, etc, etc

### TRANSFORMERS

5—50 KVA 3—10 KVA
15—25 KVA 5— 3 KVA
} from 440 V to 120 V, all single phase, 60 cycle, dry type

### BOILER

6—Express, Boilers, modied D type, Foster Wheeler, 30,000# steam hr., 435# press., with economizers, superheaters, desuperheaters, oil burners, etc.

6—Wickes Boiler 628 H.P. 3 drum, Navy Types, 250 pounds pressure.

2—Cyclotherm 3000 pounds steam per hour.

### BOILER FEED PUMPS, TURBINE DRIVEN

1—DeLaval 675 GPM 725# dischge., 4900 RPM, steam 540#

1—DeLaval 600 GPM 575# dischge., 4600 RPM, steam 400#

2—Worth'ton 750 GPM 375# dischge., 3500 RPM, steam 240#

5—Ing. Rand 165 GPM 575# dischge., 4850 RPM, steam 375#

3—DeLaval 125 GPM 575# dischge., 7000 RPM, steam 400#

### CENTRIFUGAL PUMPS

60—Various sizes up to 15,000 GPM, up to 725# disch. pr. steel and bronze motor and turbine driven.

### RECIPROCATING STEAM PUMPS

50—Simplex and duplex, various sizes, bronze and steel

### CENTRIFUGES

15—Sharples
15—DeLaval
Oil purifiers and oil clarifiers capacity 100 GPH and 150 GPH, with motors and pump

### HIGH PRESSURE COMPRESSORS

2—Ingersoll Rand type 40, 4 stage, 3000# press. 20 cft. driven by G.E. 3/60/220/440 motors 50 HP

1—same, driven by Waukesha gas engine model GBZ 1111

2—Ingersoll Rand class B, 3 stage, 3,000# press, 7½ cu. ft., driven by G.E. 3/60/440 motors, 24 HP.

### DISTILLING PLANTS

2—Griscom Russell Soloshell double effect, 8000 gals. per day, complete with pumps

3—Cleaver Brooks Co., 5000 gals. p. day, self contained units complete with boiler pumps and fans

2—Foster Wheeler 40,000 gallons per day, triple effect, low pressure.

1—Condenser Service 80 tons per day, double effect

### FANS

150—from 3,000 to 16,000 CFM at 2" to 3" S.P with AC and DC motors.

### FUEL OIL HEATERS

24—Griscom Russell sect. G-fin, 86 sq. ft.

1—Griscom Russell, 4 sect., 6 fin.

### FEED WATER HEATERS

7—Blowers (Roots Connersville) size 16" x 18", connected to G.E. induction motor, 200 H.P., 3 phase 60 cycle, 2200 Volt. 705 RPM

2—Blowers (Roots Connersville) size 20" x 23" connected to Westinghouse Electric induction motor 350 H.P., 3 phase 60 cycle, 2200 Volt, 590 RPM

Blower Motors also sold separately

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*Tel.: REctor 2-1334*

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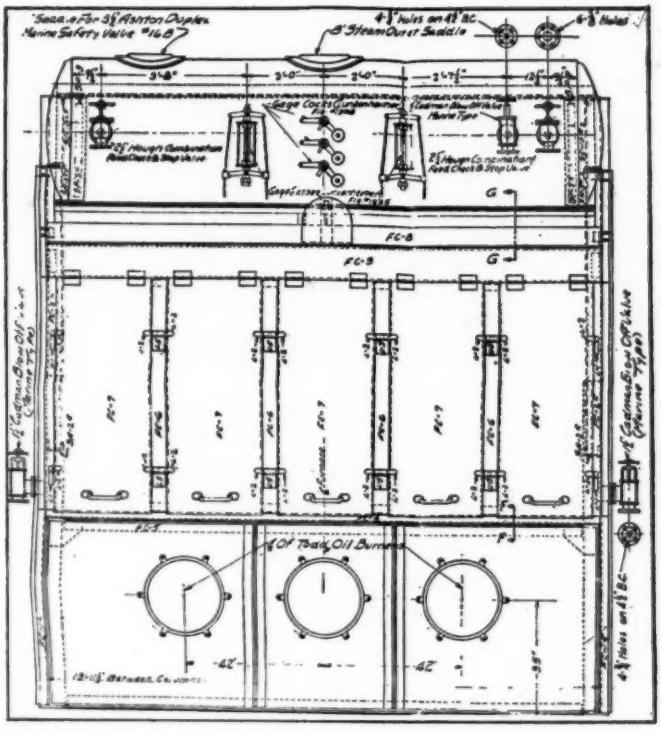
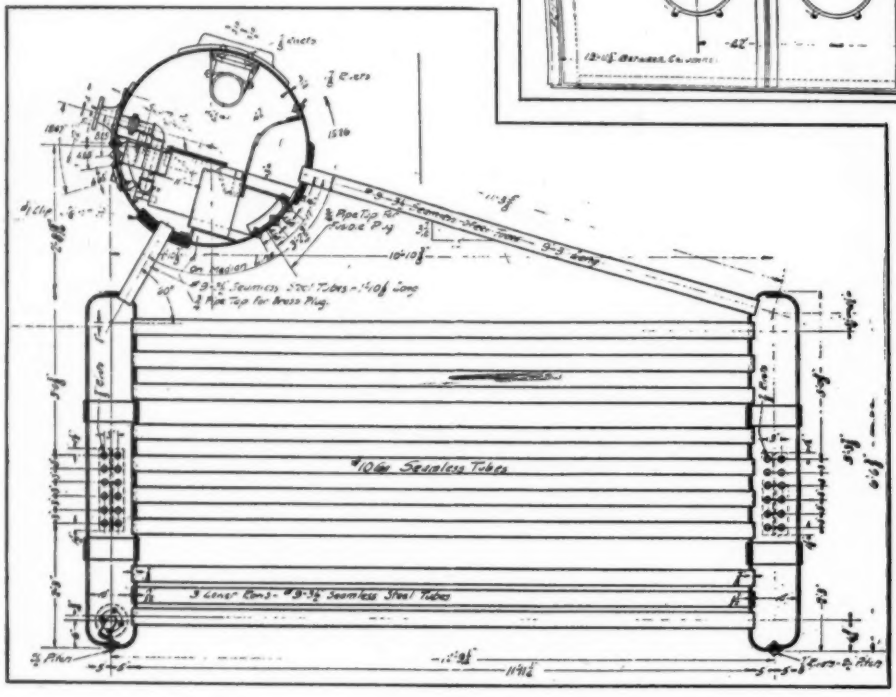
# POWER PLANT SPECIALISTS

## OFFERING FOR IMMEDIATE DELIVERY

**SIX**

400/500 HP Steel encased water tube boilers — cross drum type — 225 lbs. pressure Rebuilt and retubed 1943.





Each boiler contains 309—3½" straight tubes connected to a 42" x 14' steam cross drum and fired with 3 Todd Oil Burners — complete with all trim.

# HOWE BROTHERS

**342 MADISON AVENUE, NEW YORK 17, N. Y.**

*Tele. Nos. Mur. 2-8562-8563-8564*

# AVAILABLE

## Electric Motors

**ALL Motors are offered subject to prior sale. New Motors are in stock at this time for immediate shipment or scheduled for early delivery. Advise your requirements and delivery needs now.**

### 3 Phase—60 Cycle
### SQUIRREL CAGE

| Qu. | HP | Make | Type | Volts | Speed |
|---|---|---|---|---|---|
| 10 | ¼ | Century (new) | SC | 220/440 | 1800 |
| 17 | ¼ | Century (new) | SC | 220/440 | 3600 |
| 3 | ¼ | B-Line (Hi-Tork—new) | PM | 220 | 1200 |
| 2 | 1 | West. | CS | 550 | 765 |
| 1 | 1 | B-Line (Hi-Tork—new) | PM | 220 | 1200 |
| 34 | 1 | B-Line (new) | PM | 220/440 | 1200 |
| 1 | 1 | Delta | TS | 220/440 | 1800 |
| 15 | 1 | Century (new) | SC | 220/440 | 1800 |
| 45 | 1 | B-Line (new) | PM | 220/440 | 1800 |
| 17 | 1 | Century T. E. (new) | SC | 220/440 | 1800 |
| 1 | 1 | B-Line Xp. (new) | PM | 220 | 3600 |
| 33 | 1 | Century (new) | SC | 220/440 | 3600 |
| 1 | 1½ | B-Line (Hi-Tork—new) | PM | 220 | 1200 |
| 21 | 1½ | B-Line (new) | PM | 220/440 | 1200 |
| 1 | 1½ | G.E. (new) | KT | 220 | 1200 |
| 1 | 1½ | Lincoln Vert. | IC | 440 | 1800 |
| 1 | 1½ | Watson | KH | 440 | 1800 |
| 21 | 1½ | Century (new) | SC | 220/440 | 1800 |
| 52 | 1½ | B-Line (new) | PM | 220/440 | 1800 |
| 16 | 1½ | Century Xp. (new) | SC | 220/440 | 1800 |
| 1 | 1½ | Walker-Turner | GB-15A | 220 | 3600 |
| 1 | 2 | L. A. Vert. | F-561a | 220 | 670 |
| 16 | 2 | Century (new) | SC | 220/440 | 900 |
| 1 | 2 | G.E. | KT | 220 | 1200 |
| 30 | 2 | B-Line (new) | PM | 220/440 | 1200 |
| 1 | 2 | G.E. | KT | 220 | 1800 |
| 10 | 2 | Century (new) | SC | 220/440 | 1800 |
| 52 | 2 | B-Line (new) | PM | 220/440 | 1800 |
| 12 | 2 | Century Xp. (new) | SC | 220/440 | 1800 |
| 8 | 2 | Sturtevant T. E. (new) | | 220 | 1800 |
| 2 | 2 | Century (new) | SC | 220/440 | 3600 |
| 6 | 2 | B-Line (new) | PM | 220/440 | 3600 |
| 1 | 3 | Century (new) | SC | 220/440 | 900 |
| 7 | 3 | Century (new) | SC | 220/440 | 1200 |
| 34 | 3 | B-Line (new) | PM | 220/440 | 1200 |
| 24 | 3 | Century Xp. (new) | SC | 220/440 | 1800 |
| 76 | 3 | B-Line (new) | PM | 220/440 | 1800 |
| 40 | 3 | Century (new) | SC | 220/440 | 1800 |
| 2 | 3 | Kempsmith | PN | 440 | 1800 |
| 1 | 3 | Century | SC | 220/440 | 1800 |
| 1 | 3 | Wagner (TEFC new) | BP | 440 | 3600 |
| 3 | 3 | Century (new) | SC | 220/440 | 3600 |
| 1 | 5 | G.E. | KT | 550 | 1200 |
| 34 | 5 | B-Line (new) | PM | 220/440 | 1200 |
| 30 | 5 | Century Xp. (new) | SC | 220/440 | 1800 |
| 65 | 5 | B-Line (new) | PM | 220/440 | 1800 |
| 38 | 5 | Century (new) | SC | 220/440 | 1800 |
| 14 | 5 | Wagner (TEFC new) | BP | 440 | 3600 |
| 14 | 5 | G.E. (Splprf.) new) | K | 440 | 3600 |
| 15 | 7½ | Century (new) | SC | 220/440 | 900 |
| 10 | 7½ | Century (new) | SC | 220/440 | 1200 |
| 1 | 7½ | Delco | CT | 220/440 | 1800 |
| 81 | 7½ | Century (new) | SC | 220/440 | 1800 |
| 21 | 7½ | Century Xp. (new) | SC | 220/440 | 1800 |
| 5 | 7½ | Century (new) | SC | 220/440 | 3600 |
| 21 | 10 | Century (new) | SC | 220/440 | 1200 |
| 30 | 10 | Century (new) | SC | 220/440 | 1800 |
| 1 | 10 | G.E. | KT | 220 | 1800 |
| 1 | 10 | Century | AS | 220 | 1800 |
| 34 | 10 | Century (Xp.—new) | SC | 220/440 | 1800 |
| 5 | 10 | Century (Hi-Tork—new) | SCH | 220/440 | 1800 |
| 1 | 15 | G.E. | KF | 440 | 1200 |
| 10 | 15 | Century (new) | SC | 220/440 | 1200 |
| 4 | 15 | Century (new) | SC | 220/440 | 1200 |
| 32 | 15 | Century (Xp.—new) | SC | 220/440 | 1800 |
| 5 | 15 | Century (Hi-Tork—new) | SCH | 220/440 | 1800 |
| 30 | 15 | Century (new) | SC | 220/440 | 1800 |
| 1 | 15 | Century (new) | SC | 220/440 | 3600 |
| 1 | 15 | G.E. | KG | 220 | 1800 |
| 1 | 15 | Reliance | AA | 220 | 1800 |
| 1 | 20 | Allis Chalmers | AN | 440 | 900 |
| 1 | 20 | G.E. | KT | 220 | 1200 |
| 1 | 20 | Century (new) | SC | 220/440 | 1800 |
| 1 | 20 | West. | CS | 550 | 1800 |
| 3 | 25 | Century (new) | SC | 220/440 | 1200 |
| 3 | 25 | Century (new) | SC | 220/440 | 1800 |
| 3 | 25 | Century (Hi-Tork—new) | SCH | 220/440 | 1800 |
| 5 | 30 | Century (Hi-Tork—new) | SCH | 220/440 | 1800 |
| 1 | 35 | G.E. | IK | 440 | 600 |
| 1 | 40 | Allis Chalmers | ARV | 220 | 1800 |
| 2 | 40 | Allis Chalmers | AR | 440 | 1800 |
| 1 | 50 | G.E. | IK | 550 | 600 |
| 1 | 50 | G.E. | KT | 440 | 900 |
| 1 | 50 | G.E. | IK | 2200 | 900 |
| 2 | 50 | G.E. | IK | 440 | 600 |
| 1 | 50 | G.E. | KT | 220 | 900 |
| 1 | 50 | West. | CS | 2200 | 1200 |
| 1 | 60 | Century (new) | SC | 220/440 | 1200 |
| 2 | 60 | Electro Dynamic | (Splprf) | 440 | 3600 |
| 1 | 60 | West. | CS | 2200 | 1800 |
| 10 | 75 | Electro Dynamic (Splpf)—new) | | 440 | 600 |
| 1 | 75 | Allis Chalmers | AR | 2200 | 514 |
| 1 | 75 | G.E. | IK | 440 | 900 |
| 1 | 75 | West. | CS | 2200 | 1800 |
| 1 | 75 | Allis Chalmers | AR | 2200 | 1800 |
| 1 | 100 | Lincoln | I | 440 | 450 |
| 1 | 100 | G.E. | IK | 2200 | 720 |
| 1 | 100 | F.-M. | | 2200 | 1800 |
| 1 | 100 | Century (new) | SC | 220 | 1800 |
| 1 | 100 | L. A. (new) | | 440 | 1800 |
| 1 | 100 | Allis Chalmers | AR | 440 | 1800 |
| 4 | 100 | G.E. (new) | K | 440 | 3600 |
| 1 | 120 | G.E. | K | 550 | 1800 |
| 1 | 125 | Crocker Wheeler | | 440 | 430 |
| 1 | 125 | G.E. | IK | 550 | 720 |
| 1 | 125 | G.E. | IK | 550 | 900 |
| 1 | 125 | Electro Prod. | | 440 | 1200 |
| 1 | 125 | G.E. | K | 222 or 440 | 1200 |
| 2 | 125 | G.E. (new) | K | 440 | 1800 |
| 1 | 125 | West. (Tefc.) | CS | 440 | 1600 |
| 2 | 125 | West. (new) | CS | 550 | 1800 |
| 1 | 125 | Allis Chalmers | AR | 2200 | 1800 |
| 1 | 125 | Allis Chalmers | AR | 220 | 3600 |
| 1 | 125 | Elliot | | 2200 | 3600 |
| 2 | 150 | G.E. | IK | 550 | 600 |
| 1 | 150 | G.E. | IK | 2200 | 600 |
| 1 | 150 | F.-M. | | 440 | 1800 |
| 2 | 150 | Howell (new) | TB | 440 | 1800 |
| 2 | 150 | G.E. (new) | K | 440 | 1800 |
| 6 | 200 | West. | CS | 2200 | 600 |
| 1 | 200 | G.E. | KT | 220 | 720 |
| 1 | 200 | West. | CS | 2200 | 900 |
| 1 | 200 | Reliance (TEFC) | | 440 | 900 |
| 1 | 200 | G.E. | K | 440 | 1200 |
| 2 | 200 | Allis Chalmers | Sp. Pf. | 2300 | 180 |
| 1 | 200 | Wagner | RPZ | 440 | 1800 |
| 1 | 200 | West. | CS | 2200 | 3600 |
| 2 | 250 | Allis Chalmers | AR | 440 | 1200 |
| 1 | 250 | Allis Chalmers | AR | 2200 | 1200 |
| 2 | 300 | West. | CS | 550 | 1200 |
| 3 | 300 | West. | CS | 440 | 1800 |
| 3 | 300 | G.E. | KT | 440 | 1800 |
| 1 | 400 | G.E. | IK | 2200 | 450 |
| 1 | 450 | G.E. | IK | 2200 | 600 |
| 1 | 500 | West. | CS | 2200 | 1800 |

### Squirrel Cage Motors
### 2 Phase—60 Cycle

| Qu. | HP | Make | Type | Volts | Speed |
|---|---|---|---|---|---|
| 2 | ¼ | Century (new) | SC | 220/440 | 1200 |
| 17 | ¼ | Century (new) | SC | 220/440 | 1800 |
| 2 | ¼ | Century (new) | SC | 220/440 | 3600 |
| 1 | ½ | Century (new) | SC | 220/440 | 1800 |
| 16 | ½ | Century (new) | SC | 220/440 | 3600 |
| 2 | 1 | Century (new) | SC | 220/440 | 900 |
| 15 | 1 | Century (new) | SC | 220/440 | 1800 |
| 1 | 1 | G.E. | K | 220/440 | 1200 |
| 25 | 1 | Century (new) | SC | 220/440 | 1800 |
| 8 | 1 | Century (new) | SC | 220/440 | 1800 T.E. |
| 1 | 1 | G.E. | K | 220/440 | 1800 |
| 18 | 1 | Century (new) | SC | 220/440 | 3600 |
| 6 | 1½ | Century (new) | SC | 220/440 | 1200 |
| 10 | 1½ | Cleveland (new) | MB | 220/440 | 1800 |
| 11 | 1½ | Cleveland (new) | MB | 220/440 | 3600 |
| 6 | 2 | Century (new) | SC | 220/440 | 900 |
| 12 | 2 | Cleveland (new) | MB | 220/440 | 1200 |
| 11 | 2 | Cleveland (new) | MB | 220/440 | 1800 |
| 6 | 2 | Cleveland (new) | MB | 220/440 | 3600 |
| 6 | 2 | Century (new) | SC | 220/440 | 1800 XP |
| 1 | 2 | B-Line (new) | PM | 220/440 | 1800 |
| 7 | 3 | Cleveland (new) | MB | 220/440 | 1200 |
| 8 | 3 | Century (new) | SC | 220/440 | 1200 |
| 1 | 3 | G.E. | KQ | 220 | 1200 |
| 32 | 3 | Century (new) | SC | 220/440 | 1800 |
| 12 | 3 | Cleveland (new) | MB | 220/440 | 1800 |
| 15 | 3 | Century (new) | SC | 220/440 | 1800 XP |
| 5 | 3 | Cleveland (new) | MB | 220/440 | 3600 |
| 8 | 5 | Century (new) | SC | 220/440 | 1200 |
| 19 | 5 | Cleveland (new) | MB | 220/440 | 1200 |
| 1 | 5 | G.E. | KQ | 220 | 1800 |
| 40 | 5 | Century (new) | SC | 220/440 | 1800 |
| 22 | 5 | Cleveland (new) | MB | 220/440 | 1800 |
| 15 | 5 | Century (new) | SC | 220/440 | 1800 XP |
| 8 | 5 | Cleveland (new) | MB | 220/440 | 3600 |
| 15 | 7½ | Century (new) | SC | 220/440 | 900 |
| 10 | 7½ | Century (new) | SC | 220/440 | 1200 |
| 8 | 7½ | Cleveland (new) | MB | 220/440 | 1200 |
| 10 | 7½ | Century (new) | SC | 220/440 | 1800 XP |
| 1 | 7½ | Century (new) | SCH | 220/440 | 1800 |
| 19 | 7½ | Century (new) | SC | 220/440 | 1800 |
| 12 | 7½ | Cleveland (new) | MB | 220/440 | 1800 |
| 2 | 7½ | Century (new) | SC | 220/440 | 3600 |
| 4 | 7½ | Cleveland (new) | MB | 220/440 | 3600 |
| 1 | 7½ | G.E. (new) | KT | 220/440 | 3600 |
| 1 | 10 | West. | CS | 220 | 900 |
| 1 | 10 | Burke | EM | 220 | 900 |
| 10 | 10 | Century (new) | SC | 220/440 | 900 |
| 7 | 10 | Century (new) | SC | 220/440 | 1200 |
| 3 | 10 | Cleveland (new) | MB | 220/440 | 1200 |
| 14 | 10 | Century (new) | SC | 220/440 | 1800 XP |
| 1 | 10 | West. | CS | 220 | 1800 |
| 20 | 10 | Century (new) | SC | 220/440 | 1800 |
| 4 | 10 | Cleveland (new) | MB | 220/440 | 1800 |
| 3 | 10 | Century (new) | SCH | 220/440 | 1800 |
| 2 | 10 | Cleveland (new) | MB | 220/440 | 3600 |
| 5 | 15 | Century (new) | SC | 220/440 | 900 |
| 3 | 15 | Cleveland (new) | MB | 220/440 | 1200 |
| 2 | 15 | G.E. | KQ | 220 | 1200 |
| 2 | 15 | G.E. (new) | KQ | 220/440 | 1800 |
| 2 | 15 | Century (new) | SC | 220/440 | 1800 |
| 5 | 15 | Cleveland (new) | MB | 220/440 | 1800 |
| 15 | 15 | Century (new) | SC | 220/440 | 1800 XP |
| 11 | 15 | Century (new) | SCH | 220/440 | 1800 |
| 3 | 15 | Cleveland (new) | MB | 220/440 | 3600 |
| 1 | 20 | G.E. | KQ | 220/440 | 900 |
| 4 | 20 | Century (new) | SC | 220/440 | 1200 |
| 3 | 20 | Cleveland (new) | MB | 220/440 | 1200 |
| 1 | 20 | Century (new) | SC | 220/440 | 1800 |
| 4 | 20 | Cleveland (new) | MB | 220/440 | 1800 |
| 1 | 20 | Century (new) | SCH | 220/440 | 1800 |
| 3 | 25 | Cleveland (new) | MB | 220/440 | 1200 |
| 1 | 25 | R & M | K | 220 | 1200 |
| 2 | 25 | G.E. (new) | K | 220/440 | 1200 |
| 1 | 25 | G.E. | KR | 220 | 1200 |
| 2 | 25 | G.E. (new) | K | 220/440 | 1800 |
| 6 | 25 | Cleveland (new) | MB | 220/440 | 1800 |
| 2 | 25 | Century (new) | SCH | 220/440 | 1800 |
| 1 | 30 | Century (new) | SC | 220/440 | 1200 |
| 1 | 30 | G.E. (new) | K | 220/440 | 1800 |
| 4 | 30 | Century (new) | SCH | 220/440 | 1800 |
| 2 | 50 | West. (TEFC) | CS | 220/440 | 1800 |
| 1 | 75 | G.E. | IQ | 220 | 720 |

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# CENTRIFUGAL PUMPS—

**Fairbanks Morse 4 x 6 self oiling duplex power pump 52 to 77 gpm. @ 250 psi and 50 to 75 rpm. with top mounted motor and V-belt drive.**

**1—12000 gpm @ 95 ft. Head—** Mather Platt 20″ single stage 875 rpm.

**3— 5100 gpm @ 135 ft. Head—** Northern 12″ single stage 1150 rpm with or without 200 HP 2200 V 3 Ph 60 Cycle motor.

**3— 1825 gpm. @ 135 ft. Head—** Canada Pumps 8″ single stage 1750 rpm with or without 60 HP 550 V 3 Ph. 60 Cycle motor.

**1— 1825 gpm. @ 200 ft. Head—** Hayton Pascol 12″ single stage 1750 rpm.

**1— 1600 gpm @ 120 ft. Head—** Fairbanks Morse 6″ single stage 1750 rpm with or without 60 HP 550 V 3 Ph. 60 Cycle motor.

**3— 1460 gpm. @ 46 ft. Head—** Gould 6″ single stage 1750 rpm with or without 20 HP 550V 3 Ph 60 Cycle motor.

**1— 1460 gpm. @ 160 ft. Head—** Fairbanks Morse 16″ four stage DEEP WELL 1160 rpm with casing, couplings etc.

**1— 1200 gpm. @ 70 ft. Head—** Hayton Pascol 6″ single stage 1150 rpm.

**1— 240 gpm. @ 330 ft. Head—** Ingersoll Rand 3″ two stage 3600 rpm with 30 HP non condensing 130# turbine.

**2— 220 gpm. @ 462 ft. Head—** DeLaval 3″ three stage 3000 rpm with non-condensing 175# turbine.

**1— 120 gpm. @ 460 ft. Head—** DeLaval 2″ two stage 3500 rpm with non-condensing 175# turbine.

**1— 120 gpm. @ 35 ft. Head—** Pumps & Power 3″ single stage 870 rpm with 2 HP 440 V 3 Ph 60 Cycle motor.

**1— 120 gpm. @ 35 ft. Head—** Pumps & Power 2″ single stage 1720 rpm with 2 HP 440 V 3 Ph 60 Cycle motor.

**2— 100 gpm. @ 21 ft. Head—** Pumps & Power 2″ single stage 1140 rpm with 1 HP 440 V 3 Ph 60 Cycle motor.

**1— 120 gpm. @ 60 ft. Head—** Canada Pumps 1½″ single stage 1720 rpm with 5 HP 440 V 3 Ph 60 Cycle motor.

**1— 60 gpm. @ 25 ft. Head—** Gould 1½″ single stage 1700 rpm.

**General Machinery LTD**

GRANVILLE ISLAND, VANCOUVER, B.C. Tel. PAcific 3487

# MOTORS • GENERATORS • TRANSFORMERS

## MOTORS
### 3 PHASE—25 CYCLE—220/440 VOLTS

| H.P. | Make | Type | Frame | RPM |
|---|---|---|---|---|
| 5 | West. | CS | | 750 |
| 5 | West. | CS | | 750 |
| 5 | West. | CS | | 750 |
| 5 | West. | CS | 453 | 750 |
| 5 | West. | CS | 453 | 750 |
| 5 | G.E. | KT | 948 | 1430 |
| 5 | G.E. | KT | 948 | 1430 |
| 5 | G.E. | KT | 948 | 1430 |
| 10 | G.E. | KT | 312 | 750 |
| 15 | G.E. | I Form K | | 750 |
| 15 | West. | CS | 573 | 750 |
| 20 | West. | CS | | 730 |
| 25 | West. | CS | | 730 |
| 40 | G.E. | I Form K | | 750 |
| 75 | G.E. | I Form K | | 500 |
| 100 | G.E. | I Form K | | 750 |
| 100 | West. (2200 v.) | CS | [illegible]871:52C | 1460 |
| 125 | West. (S.R.) | CW | [illegible] | [illegible]480 |
| 150 | G.E. | I Form K | | 365 |
| 150 | G.E. (2200 v.) | I Form K | | 750 |
| 150 | G.E. (2200 v.) | I Form K | | 750 |
| 150 | Al'ls Ch. | blip Ring | | 720 |
| 150 | G.E. (2200 v.) | KT b.b. | 557[illegible] | 1470 |
| 200 | West. (2200 v.) | CS | 1013 | 480 |
| 200 | G.E. (2200 v.) | I Form K | | 485 |
| 200 | G.E. (S.R.) | I Form M | | 480 |
| 200 | West. (S.R.) | CW | 1011 | 480 |

## MOTORS
### 3 phase, 60 cycle—220/440 volts

| H.P. | Make | Type | RPM |
|---|---|---|---|
| 5 | American | Splash Proof BB. | 1200 |
| 5 | G.E. | Tri Clad | 1750 |
| 5 | G.E. | I Form K | 680 |
| 7½ | Amer. El. | Splash Proof BB. | 1200 |
| 10 | Amer. El. | Vertical BB. | 1200 |
| 10 | G.E. | KT956 | 1200 |
| 10 | G.E. | KT752 | 1200 |
| 15 | G.E. | KT312 | 855 |
| 15 | West. | CS | 1155 |
| 20 | West. | New BB. | 1200 |
| 20 | G.E. | Tri Clad BB. | 3600 |
| 20 | West. | New CS365 | 1800 |
| 25 | West. | New CS444 | 900 |
| 25 | West. | CS | 1200 |
| 30 | West. | New CS445 | 900 |
| 30 | West. | CS | 1200 |
| 40 | Cr. Wh. | | 685 |
| 40 | Lincoln | IM | 720 |
| 40 | G.E. | KT323 | 1740 |
| 50 | Al.-Ch. | | 1800 |

| H.P. | Make | Type | RPM | Ser. No. |
|---|---|---|---|---|
| 50 | Al. Ch. | | 1800 | 3K28825 |
| 60 | G.E. | I | 1800 | 292596 |
| 60 | Whse. 2200V. | CCL | 1200 | 854121 |
| 75 | Westhgse. | CS | 1800 | 2134671 |
| 100 | Westghse. | CCL | 1800 | 1043213 |
| 125 | Westghse. | CCL | 1800 | 765231 |
| 125 | Westghse. | CS | 1200 | 2318625 |
| 150 | Westghse. | CS | 1800 | 2429726 |
| 150 | G.E. | I-K | 1200 | |
| 250 | G.E. | I-K | 600 | 2246834 |
| 300 | G.E. | I-K | 720 | 2357743 |
| 400 | G.E. | I-K | 900 | 2347845 |

### FREQUENCY CHANGERS

**All Sizes in Stock. 60 cycle to 90 cycle, 100 cycle, 120 cycle, 180 cycle and any other high cycle if desired.**

### 25 CYCLE TRANSFORMERS

3—500 KVA Pennsylvania Transformers 25 Cycle, 1 Phase, 2300 Volts Primary 230/460 Volts Secondary.

### 60 CYCLE TRANSFORMERS

1—3000 KVA Kuhlman Transformer 60 Cycle, 3 Phase, 14,160 Volts Primary 240 Volts Secondary.

### 25 CYCLE GEARED MOTORS

3—10 H.P. Westghse., Frame 364 Encl. 1500/378 RPM.
1—15 H.P. Master, Frame 405 Encl., 1450/416 RPM. Exp. Proof.

### D.C. CIRCUIT BREAKERS

4—800 Amp. ITE air breakers 2 pole 250 volts complete with overload trips 600/1200 Amp.—mounted on slate panels.

### MOTOR GENERATOR SETS

2—350 KW General Electric Sets 250 Volts D.C. driven by 500 HP 3 Phase 25 Cycle motors.
1—30 KW Gen. Elec. Generator, Type DLC-203, 125 v. direct connected to 40 HP Gen. Elec. Motor, 3/440/60/720 RPM. with panel board.

### SPECIAL

1—150 HP. Fairbanks Morse Ball Bearing Motor. 3/60/440/1800 RPM.
1—75 HP. Fynn-Weischel (Wagner) Synchronous Motor Serial #345781, 3 Phase 60 Cycle 440 Volts, 1200 RPM.
1—75 HP. Fynn Weischel Synchronous Motor 3 Phase 60 Cycle 440 Volts 1200 RPM. with starting control.
1—150 HP. Fairbanks Morse Ball Bearing motor 3/60/440/1800 RPM.
1—300 HP. Gen. Elect. Synchronous Motor. Type ATI. 3/60/440/1200 RPM., .8 PF. with direct connected exciter and starting equipment.
1—300 HP. Gen. Elect. Squirrel Cage Motor. Type I15—3/60/440 1200 RPM. with starting equipment.

### NEW MOTORS

100—New motors from ½ HP. to 30 HP. in stock, 60 Cycle single and 3 Phase.

### ROTARY CONVERTER

1—2000 KW. Westinghouse Booster type Rotary Converter 230 Volt D.C.—3 to 6 Phase, 25 Cycle, 4600 Volt Transformer.

### AIR COMPRESSORS

**2—5000 CFM Worthington low pressure 45 lb. Compressers with 500 H.P. Gen. Elect. Motors. 3 phase 25 cycle 2300 volts.—Complete.**
**2—1000 CFM 100 lb. Compressers Driven by 200 HP. Motors.**
**1—1700 CFM Worthington 2 Stage 100 lb. with motor.**

2—5000 CFM, Worthington 45# low pressure. Complete with 500 HP. Gen. Elect. Synchronous motors, 3 Ph. 25 Cy. 2300 Volts.

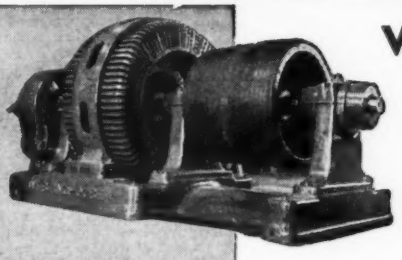
### 2300 VOLT PRIMARY CONTACTORS

2—150 H.P. Westinghouse AC magnetic controllers 3/60/2300 V.
1—225 H.P. Square D magnetic controller 3/60/2300 V.
2—200 Amp. Schweitzer-Conrad Load Breaks—3 Pole Fused. 3/60/2300 V.

**ERIE ELECTRIC CO., INC.** 124 CHURCH ST. BUFFALO, N. Y. CL. 4758

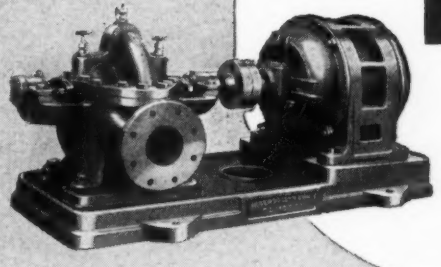
# get PUSH! behind production

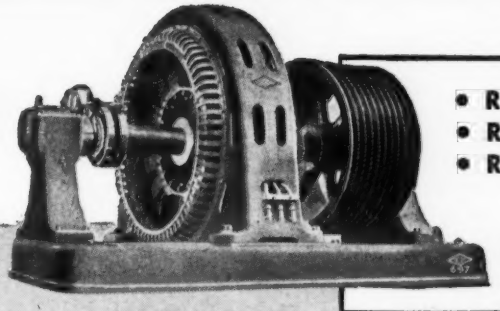
## with *Rebuilt* POWER EQUIPMENT



Whether you need a single motor —or a complete power plant installation, you'll find the ideal answer to your equipment problems at Chicago Electric Company. Boasting the nation's largest and most complete stock of rebuilt equipment Chicago Electric is prepared to furnish any size unit—for any size job. You can save time, trouble and money by specifying *Chicago Electric Rebuilts* . . . They're guaranteed *same as new.*

**CHICAGO ELECTRIC CO., 1320 W. Cermak Rd., Chicago 8, Ill.**





- REBUILDING
- REPAIRING
- REWINDING
- BUYING
- SELLING
- RENTAL

# REBUILT POWER EQUIPMENT

**READY TO SHIP!**

### ALTERNATING CURRENT MOTORS

**3 ph., 60 cy.**

| H.P. | Make | Volts | R.P.M. | Type |
|---|---|---|---|---|
| 7½ | Westg. | 220 | 1200 | CS-Sq. Cg. |
| 10 | G.E | 220 | 1200 | MT-Slipring |
| 25 | Westg. | 220 | 570 | Sq. Cg. |
| 35 | Westg. | 440 | 680 | CCL-Sq. Cg. |
| 35 | G.E. 220/440/2200 | | 865 | I-Slipring |
| 40 | G.E | 440 | 1200 | KT-Sq. Cg. |
| 40 | Reliance | 220/440 | 670 | Sq. Cg. |
| 50 | G.E. | 440 | 1200 | KT-Sq. Cg. |
| 75 | Ideal | 220 | 1200 | AT-Sq. Cg. |
| 100 | Flynn Weischel | 220/440 | 900 | 31V-RN Sq. Cg |
| 100/125 | Cr.Wh. | 220/440 | 1200 | Sq. Cg. |
| 125 | G.E. 220/440/550 | | 515 | Sq. Cg. |
| 175 | Elliott | 2300 | 720 | Sq. Cg. |
| 200 | Cr.Wh. | 440 | 505 | SR-Slipring |
| 200/250 | Westg. | 220/440 | 1800 | CW-Slipring |
| 400 | Westg. | 2200 | 435 | CW Slipring |

### COMPRESSORS

2—315 cu. ft. 100# pres. Ingersoll Rand Models 315 and 315A Portable Air Compressors with 105 Hp. Waukesha Oil Engines complete with accessories.
1—610 cu. ft. 100# pressure Burry Horiz. Compressor.

### VARIABLE SPEED MOTORS

**230 VOLT D. C.**

| H.P. | Make | R.P.M. | Type |
|---|---|---|---|
| 40 | Roth | 385/1200 | |
| 163 | G.E. | 545/1090 | CD |
| 300 | G.E. | 400/600 | DMC |
| 400 | Westg. | 180/250 | NA |
| 25 | Westg. | 600/1200 | SK |
| 25 | Westg. | 325 975 | S |
| 10/15 | Electro Dy. | 600/1200 | |
| 10 | Westg | 800/1600 | SA |
| 10 | Cr. Wh. | 690/895 | CMC |
| 10 | Westg. | 400/1600 | SA |
| 10 | Sprague | 625/1250 | LC |
| 4 | G.E. | 850/1700 | LC-8 |
| 3 | Roth | 500/1000 | RS |

### SERIES WOUND MOTORS

| H.P. | Make | Volts | R.P.M. | Type |
|---|---|---|---|---|
| 175 | G.E. | 230 | 475 | MD |
| 80 | Westg. | 220 | 450 | 76-A |
| 68 | G.E. | 220 | 495 | CO-2007 |
| 50 | Northern | 220 | 600 | K |
| 40 | G.E. | 230 | 517 | |
| 35 | Westg. | 230 | 550 | 49D |
| 32 | Shaw | 230 | 485 | 5L2F |
| 3½ | Westg. | 230 | 1200 | L |

### 230 VOLT DC MOTORS

| H.P. | Make | R.P.M. | Type |
|---|---|---|---|
| 1/6 | Bodine | 3400 | |
| ¼ | Triumph | 525 | 14-F |
| 1½ | Master | 3450 | DM |
| 2 | Westg. | 1725 | CD |
| 3 | Westg. | 1725 | CD |
| 3 | Western Elec. | 1125 | E-20-R |
| 3½ | Westg. | 975 | S |
| 4 | G.E. | 850 | LC-8 |
| 5 | Westg. | 1150 | SK |
| 7½ | Westg. | 1150 | SK |
| 7½ | G.E. | 1700 | RC |
| 8 | G.E. | 950 | RC-11 |
| 10 | Cr. Wh. | 850 | CM |
| 10 | Westg. | 1750 | SK |
| 12 | Northern | 1475 | |
| 15 | Allis Chal. | 800 | |
| 20 | Westg. | 1750 | SK |
| 20 | Westg. | 600 | M |
| 20 | Westg. | 975 | S-6 |
| 25 | G.E. | 650 | MD |
| 25 | Westg. | 825 | SK113 |
| 25 | Westg. | 1150 | SK |
| 30 | Westg. | 700 | S-6 |
| 40 | Westg. | 625 | MC |
| 60 | Reliance | 1800 | |
| 80 | Westg. | 450 | 76-A |
| 163 | G E. | 545 | CD |
| 200 | Cr. Wh. | 600 | CCM |
| 250 | Elliott | 850 | |

### MOTOR GENERATOR SETS—

1—150 KW. 720 rpm. 250 v. DC General Electric Generator direct driven by 1—175 HP 2300 v. 720 rpm. 3 ph. 60 cy. Elliott synchronous motor.
1—175 KW. 250/275 v. 1200 rpm. Elliott Generator direct connected to a 3 ph. 60 cy. 440 v. 1200 rpm. Westinghouse motor.
1—200 KW. 125/250 v. DC Motor Generator Set consisting of
2—100 KW. 125 v. DC compound wound Generators direct coupled to 1—225 HP. 1200 rpm. 220 or 440 v. 3 ph. 60 cy. Westg. slip ring motor.
1—150 KW. 500 v. compound wound Ridgway Generator 900 rpm. direct connected to a 225 HP. 2200 v. 3 ph. 60 cy. Ridgway Synchronous Motor.
4—100 KW. 1200 rpm. 125 v. DC compound wound General Electric Generators direct driven by 127.5 KVA, 220 or 440 v. 3 ph. 60 cy. 1200 rpm. synchronous motors.
1—15 KW. 1150 rpm. 115/230 v. DC Westg. Generator direct driven by 20 HP. 220 v. 3 ph. 60 cy. type CS motor.
1—12½ KW. 110/220 v. single ph. 60 cy. 1800 rpm. Burke Electric AC Generator with a 20 HP. 230 v. DC motor.
1—75 KW. 250 v. compound wound Westg. Generator direct connected to a 100 HP. 3 ph. 60 cy. 220 or 440 v. Fynn Weischel synchronous motor.

### INDUSTRIAL TRUCKS

5—Automatic type LO-5 Low Lift Trucks capacity 5 ton, platform type. Equipped with towing coupler and bumper for pushing cars.
5—New 4 ton Yale & Towne model Y8W Multi-Stroke Hand Lift Platform Trucks.

### PUMPS

1— 130 gpm. 50 ft. head Rayton Dowd Pump.
1— 378 gpm. 44 ft. head Dayton Dowd Pump.
1— 400 gpm. 16 ft. head Dayton Dowd Pump.
1— 500 gpm. 35 ft. head Dayton Dowd Pump.
1— 550 gpm. 88 ft. head Dayton Dowd Pump.
1— 600 gpm. 32 ft. head Dayton Dowd Pump.
1— 750 gpm. 20 ft. head Dayton Dowd Pump.
1— 750 gpm. 70 ft. head Dayton Dowd Pump.
1—3500 gpm. 90 head DeLaval Pump.
1—4000 gpm. 138 ft. head Ingersoll-Rand Pump.
1—8000 gpm. 100 ft. head American Well Works Pump.

***WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US***

## Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

## Write—Wire—Phone

**us if you don't see the item you need. This listing is only a part of our large stock.**

### M-G SETS

**Others available—special units built to order.**

200 KW Gen. Elec. MPC gen. DC 125 V. coupled to 300 HP G.E. synch. motor 3/60/440 V. 900 RPM.
150—KW Gen. Elec. type MPC gen. DC 125 V. coupled to 225 HP sq. cage motor 3/60/2200 V. 1200 RPM.
75 KW Cr. Wheeler 65 H gen. DC 125 V. coupled to 100 KVA synch. motor 3/60/440 V.
75 KW G.E. DLC gen. DC 125 V. coupled to 115 HP sq. cage motor 3/60/220/440 V. 1200 RPM.
37½ KVA. Whse. AC gen. 3/60/240 V. coupled to 50 HP Whse. SK motor DC 230 V. 1150 RPM. 3 brg.
35 KW G.E. CD gen. DC 48 V. 750 amp. coupled to 60 HP motor 3/60/220/440 V. 1200 RPM.
2—10 KW Whse. like new, DC 250 V. output, AC motor 3/60/220/440 V.

### D. C. MOTORS

| H.P. | Mfg. | Type | Volts | Speed |
|---|---|---|---|---|
| 250 | Whse. | ped. | 230 | 275/690 |
| 100/150 | G.E. dynamon. | TLC | 250 | 1000/3500 |
| 75 | Whse. | S136 | 125 | 475 |
| 75 | Gen. Elec. | BRC | 115 | 1150 |
| 65 | G.E. Northern | C | 230 | 375/750 |
| 60 | Diehl dynamon. | R10 | 250 | 500/2000 |
| 60 | G.E. b.b. | CDM103 | 230 | 1750 |
| 50 | Burke | | 230 | 250/1000 |
| 50 | G.E. Sprague | IC | 250 | 700 |
| 50 | Cr. Wheeler | 50H | 230 | 700 |
| 40 | Roth | S | 115 | 850 |
| 35/50 | Gen. Elec. | CD123 | 230 | 575/1150 |
| 25 | Roth | RS | 230 | 1750 |
| 25 | Gen. Elec. | DLC | 115 | 750 |
| 25 | Roth | elevator | 230 | 725 |
| 25 | Whse. enclosed | SK | 230 | 600 |
| 25 | G.E. b.b. New | CD93 | 115 | 1150 |
| 20 | G.E. b.b. New(2) | CD83 | 115 | 1750 |
| 20 | Reliance | T | 230 | 850 |
| 20 | Imperial Int. dty. | D37 | 230 | 1200 |
| 20 | Gen. Elec. | IC | 230 | 575 |
| 20 | Gen. Elec. | DLC | 230 | 500/1500 |

### SLIP RING MOTORS

**3 Phase, 60 Cycle, 220 or 440 Volts**

| Qu. | H.P. | Mfg. | Type | Speed |
|---|---|---|---|---|
| 1 | 400 | Gen. Elec. 3 brg. | I-P | 450 |
| 1 | 300 | Burke | EMV | 225 |
| 1 | 200 | Gen. Elec. | I-M | 1800 |
| 1 | 200 | G.E. 2200 v. | I-M | 360 |
| 1 | 200 | Whse. 3 brg. | HF | 600 |
| 1 | 100 | Whse. | CW761C | 1800 |
| 1 | 75 | Ideal | A350 | 720 |
| 1 | 60 | Howell | SR | 1800 |
| 1 | 60 | Ideal 2200/4000 v. | A | 1800 |
| 2 | 40 | Allis Ch. | ANY | 450 |
| 2 | 37 | G.E. int. duty | ITC | 1200 |
| 1 | 37 | G.E. int. duty | ITC | 600 |
| 1 | 35 | Lancashire b.b. | late | 1800 |
| 1 | 30 | Gen. Elec. | MT346 | 600 |
| 2 | 30 | Gen. Elec. | OMT336 | 1200 |
| 1 | 25 | G.E. int. duty | ITC | 1200 |
| 1 | 25 | Gen. Elec. | I-M | 600 |
| 1 | 25 | Triumph | SR | 1200 |
| 1 | 15 | Gen. Elec. | I-M | 900 |
| 2 | 15 | F. Morse | BV | 1200 |
| 1 | 15 | Watson | KHV | 720 |
| 4 | 10 | Century New b.b. | SRT326 | 1200 |

### SYNCHRONOUS MOTORS

| H.P. | Mfg. | Type | Volts | Speed |
|---|---|---|---|---|
| 225 | KVA Gen. Elec. | ATI | 220/440 | 900 |
| 150 | Whse. | | 220/440 | 600 |
| 125 | Whse. | G | 2200 | 900 |
| 100 | KVA Cr. Wheeler | | 220/440 | 900 |
| 75 | Elec. Machy. | BRKT | 550 | 900 |
| 60 | Elec. Machy. | BRKT | 220/440 | 1200 |

**Special—50 H.P. Gearhead Motors—Howell bb 2 speed 1800/900 RPM 3/60/440 V. attached to D. O. James spur gear reducer, output 158/79 RPM, like new.**

* * * *

***Also many speed reducers and gear motors in stock up to 15 H.P.***

### SQUIRREL CAGE MOTORS

**3 Phase, 60 Cycle, 220 or 440 Volts**

| Qu. | H.P. | Mfg. | Type | Speed |
|---|---|---|---|---|
| 1 | 400 | G.E. 2200 v. | I-K | 1800 |
| 1 | 175 | G.E. 2200 v. | I-K | 600 |
| 1 | 125 | Whse. 2200 v. | CS 505 | 3600 |
| 1 | 125 | Northwn. | H | 1800 |
| 1 | 75 | Gen. Elec. | I-K | 720 |
| 1 | 60 | Ideal | A | 1200 |
| 2 | 50 | Whse. New | CS 445 | 1800 |
| 1 | 50 | Whse. | CCL | 900 |
| 2 | 50 | Whse. 2200 v. vert. | CS | 900 |
| 1 | 40 | Gen. Elec. | I-K | 900 |
| 1 | 40 | Allis Ch. 3 spd. | ARX | 900/600/450 |
| 1 | 40 | Whse. | CCL | 720 |
| 1 | 40 | Gen. Elec. | I-K | 1200 |
| 2 | 35 | Gen. Elec. | I-K | 720 |
| 2 | 30 | Howell b.b. 4 spd. | SC | 1800 |
| 1 | 30 | F. Morse | BH | 600 |
| 2 | 25 | Gen. Elec. | I-K | 720 |
| 1 | 25 | Gen. Elec. | I-K | 600 |
| 2 | 20 | Gen. Elec. | I-K | 720 |
| 1 | 20 | F. Morse | BH | 900 |
| 2 | 20 | Whse. New b.b. | CS 364 | 1800 |
| 2 | 20 | Gen. Elec. | KT 312 | 1200 |
| 2 | 20 | Century b.b. 4 spd. | SC 504 | 1800 |
| 2 | 20 | Whse. New TEFC | CS 364 | 1800 |

### 25 CYCLE MOTORS

| H.P. | Mfg. | Type | Speed |
|---|---|---|---|
| 450 | Whse. 2200 v. | CW sl. rf. | 750 |
| 150 | Whse. | HF sl. rg. | 500 |
| 150 | Whse. | C sq. cg. | 500 |
| 100 | Whse. | CCL sq. cg. | 500 |
| 50 | Allis Ch. | ANY sl. rg. | 1500 |

### D. C. GENERATORS

| KW | Mfr. | Type | Volts | Speed |
|---|---|---|---|---|
| 300 | Gen. Elec. 1 | MPC | 125/170 | 1150 |
| 75 | Whse. | S | 125 | 600 |
| 50 | Cr. Wheeler | CCD | 250 | 850 |
| 30 | Lincoln b.b. 600 amp. | | 50 | 1200 |
| 25 | Gen. Elec. | DLC | 125 | 900 |
| 20 | Allis Ch. (2) | | 125 | 475 |

### 60 CYCLE A.C. GENERATORS

| KVA | Mfr. | Type | Volts | Speed |
|---|---|---|---|---|
| 300 | Gen. Elec. | ATB | 240/480 | 600 |
| 250 | Gen. Elec. | ATB | 240/480 | 600 |
| 225 | Gen. Elec. | ATB | 240/480 | 900 |
| 165 | Elec. Machy. | BRKT | 240/480 | 900 |
| 150 | Allis Ch. 25 cycle | | 240/480 | 500 |
| 150 | Allis Ch. | B | 2300 | 900 |

## ARTHUR WAGNER COMPANY

**1436-38 W. RANDOLPH STREET — CHICAGO 7, ILL. — MONroe 7409**

## NEW—REBUILT & GUARANTEED MOTORS-M-G SETS-TRANSFORMERS

### A. C. MOTORS

**3 ph. 60 cycle**

| Qn. | H.P. | Make | Type | Volts | Speed |
|---|---|---|---|---|---|
| 10 | ½ | G.E. | KT | 220/440 | 3600 |
| 5 | ¾ | G.E. | KT | 220/440 | 1800 |
| 4 | 2 | G.E. | KT | 220/440 | 1200 |
| 1 | 2 | G.E. | Exp. Proof | 220/440 | 1800 |
| 1 | 2 | West. | Vertical | 220/440 | 1200 |
| 2 | 3 | G.E. | KT | 220/440 | 900 |
| 2 | 3 | West. | CSP-254 | 220/440 | 1800 |
| 10 | 5 | New West. | CSP-254 | 220/440 | 1800 |
| 1 | 5 | New West | Tefc. B. B. | 220/440 | 1800 |
| 1 | 5 | New West. | Tefc. B. B. | 220/440 | 1200 |
| 1 | 7½ | G.E. | KT-180 | 220/440 | 1800 |
| 2 | 10 | W. B. Brg. | CS-326 | 220/440 | 1200 |
| 4 | 10 | Al. Ch. | AN | 220/440 | 1200 |
| 2 | 10 | West. | CS | 220/440 | 1200 |
| 1 | 15 | W. B. Brg. | 365 | 220/440 | 1200 |
| 5 | 15 | Al. Ch. | AN | 220/440 | 1200 |
| 1 | 15 | G.E. B. B. | KT | 220/440 | 720 |
| 1 | 20 | G.E. | I-K | 220/440 | 600 |
| 2 | 20 | Wagner | BP | 220/440 | 1300 |
| 1 | 25 | Gen. Elec. | KT | 220/440 | 900 |
| 4 | 25 | Al. Ch. | AN | 220/440 | 1200 |
| 1 | 25 | Cr. Wh. | Sl. Rg. | 220/440 | 1200 |
| 1 | 25 | Lincoln | | 220/440 | 1200 |
| 2 | 30 | W. E. | KT | 220/440 | 900 |
| 3 | 30 | Al. Ch. | AN | 220/440 | 1200 |
| 2 | 30 | West. | CS | 220/440 | 720 |
| 3 | 35 | G.E. | I-K | 220/440 | 900 |
| 1 | 35 | Al. Ch. | AN | 220/440 | 1200 |
| 2 | 40 | Gen. Elec. | IK | 220/440 | 1200 |
| 1 | 50 | Gen. Elec. | KT-346 | 220/440 | 900 |
| 2 | 50 | Gen. Elec. | K7337 | 220/440 | 1800 |
| 3 | 50 | West. | CS | 220/440 | 1800 |
| 2 | 60 | Allis Chal. | | 220/440 | 1800 |
| 1 | 60 | Rob. Meyers | K-209 | 220/440 | 1200 |

### A. C. MOTORS

**3 ph.. 25 cycle**

| Qn. | H.P. | Make | Type | Volts | Speed |
|---|---|---|---|---|---|
| 18 | 2 | G.E. | KT-731 | 220/440 | 750 |
| 5 | 5 | Howell | SC-232 | 220/440 | 750 |
| 14 | 5 | G.E. | KT | 220/440 | 750 |
| 5 | 5 | West. | CCL | 220/440 | 750 |
| 1 | 7½ | West. | CS | 220/440 | 750 |
| 4 | 7½ | G.E. Sl. Rg. | I-M | 220/440 | 750 |
| 2 | 10 | West. | CS | 220/440 | 500 |
| 1 | 10 | G.E. | I-M | 220/440 | 750 |
| 1 | 10 | G.E. | KT | 220/440 | 750 |
| 1 | 15 | Howell B.B. | SCR | 220/440 | 500 |
| 1 | 15 | G.E. | I | 220/440 | 750 |
| 2 | 15 | Gen. Elec. | IK | 220/440 | 750 |
| 2 | 20 | Gen. Elec. | IK | 220/440 | 750 |
| 3 | 20 | G.E. | KT | 220/440 | 750 |
| 1 | 20 | W. Sl. Rg. | CW | 220/440 | 750 |
| 2 | 25 | G.E. | I-K | 220/440 | 750 |
| 1 | 25 | W. Sl. Rg. | CW | 220/440 | 750 |
| 1 | 25 | Burke S. R. | WEV | 220/440 | 750 |
| 2 | 25 | Gen. Elec. | KT-337 | 220/440 | 750 |
| 2 | 25 | Westinghouse | CS | 220/440 | 750 |
| 2 | 30 | Allis Chal. | | 220/440 | 750 |
| 1 | 50 | Western | I-K | 220/440 | 75 |
| 1 | 60 | Gen. Elec. | IK | 220/440 | 1500 |
| 1 | 100 | G.E. | I-K | 220/440 | 750 |
| 1 | 200 | West. | CS | 220/440 | 750 |
| 1 | 200 | G.E. | I-K | 220/440 | 750 |
| 1 | 3 | G.E. | KT-160 | 220/440 | 1500 |
| 7 | 5 | G.E. | KT | 220/440 | 1500 |
| 2 | 5 | G.E. Sl. Rg. | MT-181 | 220/440 | 1500 |
| 7 | 5 | West. | CS | 220/440 | 1500 |
| 1 | 7½ | G.E. | I-K | 220/440 | 1500 |
| 1 | 15 | West. | CS | 220/440 | 1500 |
| 1 | 25 | Wagner | BP | 220/440 | 1500 |
| 1 | 250 | G.E. | I | 220/440 | 1500 |

### TRANSFORMERS

| Qn. | KVA | Cycle | Voltage | Make | Type |
|---|---|---|---|---|---|
| 1 | 2 | 60 | 2300/115/230 | G.E. | H |
| 1 | 2½ | 60 | 2300/115/230 | G.E. | H |
| 1 | 3 | 60 | 2300/115/230 | G.E. | H |
| 1 | 3 | 60 | 2300/110/220 | Pitts. | |
| 1 | 5 | 25 | 440/110/220 | Pitts. | |
| 1 | 5 | 25 | 2220/220/110 | West. | S |
| 2 | 7½ | 60 | 2200/220/110 | West. | |
| 1 | 10 | 25 | 2300/230/115 | G.E. | H |
| 5 | 15 | 60 | 2300/110/220 | Pitts. | |
| 1 | 15 | 60 | 2300/115/230 | G.E. | |
| 2 | 25 | 25 | 2300/115/230 | Pitts. | |
| 2 | 50 | 60 | 2200/110/230 | Pitts. | |
| 1 | 50 | 25 | 2300/230/460 | Pitts. | |
| 3 | 75 | 60 | 2200/120/240 | G.E. | H-K |
| 1 | 10,000 | 60 | 33,200/4,600 | Pitts. | |

### M.G. SETS

1—22½ KW. 250 volt, D.C. Driven by Westinghouse type CCL 3 ph., 60 cycle.

**100 New 1 H.P. Peerless Splash proof Ball Bearing Motors, 3 ph. 60 cycles, 220 Volt., 1800 RPM.**

***We buy for cash. Send us your list of surplus equipment.***

## VOLLAND ELECTRIC EQUIPMENT CO., INC.

**1512 NIAGARA STREET — BUFFALO 13, N Y.**

**PHONE GR 2715**

# THE PICK OF POWER EQUIPMENT

### TURBINE UNITS—60 Cy.

2—6250 KW Gen. Elec. Cond. 25 Cycle
1—5000 KVA General Electric Cond.
1—4000 KW General Electric Cond.
2—3750 KVA Westinghouse Cond.
1—3750 KVA Westinghouse Extrac.
1—3125 KVA General Electric Cond.
2—3125 KVA General Electric Extrac.
1—1563 KVA Westinghouse Extrac.
2—1250 KVA General Electric Cond.
1— 225 KVA General Electric Non-C.

### STEAM ENGINE UNITS—60 Cy.

1—900 KW Hamilton Uniflow
1—750 KVA Chuse Uniflow
1—500 KVA Chuse Uniflow
1—375 KVA Harrisburg Uniflow
1—325 KVA Skinner Uniflow
1—312 KVA Ames Uniflow
1—300 KVA Skinner Uniflow
1—225 KVA Skinner Uniflow
1—150 KVA Ames Uniflow
1—150 KVA Harrisburg 4-valve

### D.C. STEAM ENGINE UNITS

1—600 KW Ames Uniflow, 250 V.
1—500 KW Ames Uniflow, 250 V.
1—400 KW Ames Uniflow, 250 V.
1—350 KW Ridgway Uniflow, 250 V.
1—300 KW Skinner Uniflow, 275 V.
1—150 KW Ridgway 4-valve, 125/250 V.

### DIESEL ENGINE UNITS

2—1600 HP Gen. Motors, 2400 V. 60 cy. gen.
1— 750 HP Worthington, 250 V., 60 cy. gen.
1— 750 HP Cooper Bessemer, 460 V. 60 cy. gen.
4— 720 HP Amer. Loco., 240 V. DC.
1— 625 HP Worthington, 240 V. 60 cy. gen.
1— 500 HP Gen. Motors, 480-2400 V. gen.
1— 300 KW Buckeye, 450 V. 60 cy. gen.
1— 300 HP McInt. & Sey., 480 V. 60 cy. gen.
2— 250 HP Gen. Motors, 460 V. 60 cy. gen.
1— 150 HP Buckeye, 400 RPM eng. only
2— 30 KW Buda 6DTG-317, 3-60-127/220 V.

### WATER TUBE BOILERS

2—1409 HP B. & W., 650-lb. Stokers
2— 748 HP EdgeMoor 250-lb. Stokers
2— 560 HP Erie City 460 lb.
1— 519 HP Titusville 200-lb., Stoker
2— 469 HP B. & W. 425-lb., Pulverizer
5— 492 HP Heine 180-lb., Stokers

### SYNCHRONOUS MOTORS

4—6000 HP G.E. 60 cycle 2300 volts 90 RPM
4— 400 HP West. 2300 V. 600 RPM
1— 300 HP G.E. 60 cy. 2200 V. 600 RPM
1— 300 HP West. 60 cy. 2300 V. 900 RPM
1— 200 HP West. 60 cy. 2300 V. 900 RPM
1— 150 HP G.E. 2300 V. 240 RPM (Super)

### INDUCTION MOTORS—60 Cy.

1—1000 HP West. S/R, 2200 V. 360 RPM
1— 500 HP G. E. S/R, 2200 V. 3600 RPM
3— 150 HP C. W. S/C, 440 V. 1200 RPM
2— 150 HP G. E. S/C, 440 V. 600 RPM
1— 150 HP G. E. S/C, 2300 V. 1800 RPM
2— 120 HP G. E. S/C, 220 V. 3600 RPM

### MOTOR GENERATOR SETS

1—1500 KW Allis Chal. 600 V. DC, 60 cy.
1— 400 KW Allis Chal. 275 V. DC, 25 cy.
2— 300 KW Allis Chal. 275 V. DC, 25 cy.
1— 300 KW Westinghouse 250 V. DC, 60 cy.
1— 250 KW Allis Chal. 275 V. DC, 25 cy.
2— 225 KW Gen. Elec. 115 V. DC, 60 cy.
2— 125 KW Westinghouse 115 V. DC, 60 cy.
1— 75 KW Westinghouse 125 V. DC, 60 cy.

### ROTARIES—60 Cy.

1—2000 KW Allis Chalmers 600 V.
1—1000 KW Allis Chalmers 600 V.
1— 750 KW Westinghouse 275 V.
1— 750 KW General Electric 600 V.
1— 500 KW General Electric 275 V.

### FREQUENCY CHANGERS

1—2150 KVA G. E. 25/62½ cy. 750 RPM
1—1875 KVA G. E. 25/60 cy. 300 RPM
1—1200 KVA G. E. 25/60 cy. 300 RPM
2—1000 KVA G. E. 25/60 cy. 300 RPM
1—1000 KVA Al. Ch. 25/62½ cy. 375 RPM
1— 938 KVA West. 25/62½ cy. 750 RPM
1— 600 KVA G. E. 60/25 cy. 300 RPM

### TRANSFORMERS—1 Ph. 60 Cy.

2— 2000 KVA West. 69/34.5-4.8/2.4 KV
1— 3500 KVA West. 33000/13800-3 ph.
4— 333 KVA Al. Ch. 25410/44000-13200/23000Y V.
1—10000 KVA West. 26400-4580 V. 3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
1— 1000 KVA G. E. 24000-11500 V. 3 ph.
2— 1000 KVA G. E. 23000/11500-575 V.
1— 3750/5000 KVA West. 22000/460 V. 3 ph.
1— 3000 KVA Kuhlman 13800-240 V. 3 ph.
2—10000 KVA Pitts. 13200-4600 V. 3 ph.
2— 1000 KVA G. E. 11500/23000-575 V.
2— 1500 KVA Al. Chal. 2400-480 Chlorextol
3— 250 KVA Moloney 2300-240/480
3— <15 KVA West. 440-220/110 V.

### OIL CIRCUIT BREAKERS

| | | |
|---|---|---|
| 2— | 400 A. 25 KV G. E. FKO136 | Outdoor |
| 2— | 1000 A. 23 KV Kelman CB76 | Outdoor |
| 4— | 600 A. 15 KV G. E. FHKO139-24BS | Outdoor |
| 1— | 600 A. 15 KV G. E. FKO37 | Pole type |
| 2— | 400 A. 15 KV G.E. FHKO136 | Outdoor |

*PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT*

## BREW, WOLTMAN & CO., INC.

50 Church Street New York City 7, New York

### SYNCH. CONVERTERS

500 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM, 6 PH, 60 CY, SWITCHGEAR AND TRANSFORMERS.
150 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM, 6 PH, 60 CY, SWITCHGEAR AND TRANSFORMERS

### MOTOR GENERATORS

500 KW G.E. SYN. 250 V. 2200/4000 A.C. 1200 RPM, 3 PH, 60 CY. COMPLETE MANUAL SWITCHGEAR.
300 KW RIDGWAY SYN. 250 V. 2200 A.C. 1200 RPM, 3 PH, 60 CY. COMPLETE MANUAL SWITCHGEAR.
150 KW G.E. SYN. 250 V. 2300 A.C. 1200 RPM, 3 PH. 60 CY. COMPLETE MANUAL SWITCHGEAR.

**Each unit listed above is owned by us and is available now for immediate purchase**

**WALLACE E. KIRK COMPANY**
**Incorporated**
**502 Grant Building, Pittsburgh, Pa.**

**FOR SALE**
50, 100, 125, 200, 350 HP Slip Ring Motors
50, 75, 150, 200, 800 HP Sq. Cage Motors
1/4, 1/3, 5/8 HP Single Phase Motors
17,500 (2) Barrel Steel Storage Tanks
810 HP (2) Fuel Diesels, 450 RPM
250 HP, 600 RPM Synchronous Motor
35 HP, 100# P. Firebox Boiler
**H. & P. MACHINERY CO.**
6719 Etzel Ave., St. Louis 14, Mo.

## POWER PLANT EQUIPMENT

*Special Offerings*

### TURBO-GENERATORS

1—10,000 KW 11,000V Cond.
3— 3,000 KW 600 V Cond.
1— 2000 KW 600 V Cond.
1— 2000 KW 480 V N.C.
2— 1500 KW 2300 V Cond.
1— 1250 KW 2300 V Cond.
2— 1000 KW 480 V Cond.
1— 1000 KW 2300 V Cond.
1— 600 KW 240 V Cond.
2— 500 KW 600 V Cond.
1— 500 KW 240 V Cond.
1— 250 KW 240 V N. D.
1— 125 KW 600 V Extrac.
1— 50 KW 220 V AC, N.C.

### ENGINE GENERATORS

2—600 KW, 2300 V. Uniflow
1—168 KW. 600 V.
1—250 KW. 480 V.
1—125 KW. 125/250 V.D.C. Uniflow

### BELTED GENERATORS

1—520 KW 600 V 360 RPM
1—500 KW 600 V 225 RPM
1—350 KW 600 V 300 RPM
1—300 KW 480 V 450 RPM
1—120 KW 240 V 600 RPM

### BOILERS

1—90,000# 550 PSI
1—50,000# 250 PSI
1—30,000# 425 PSI
2—507 HP 160#
1—500 HP 400#
1—460 HP 250#
1—200 HP 160# HRT
1—150 HP 150# HRT
1— 75 HP 150# NEW

### AIR COMPRESSORS

1—6000 CFM 50# Motor
1—1573 CFM 100# Motor
1—1300 CFM 50# Steam
1— 741 CFM 100# Belted
1—5000 CFM 10# G. Rotary Type Driven by 440V. Syn. Motor.

### TRANSFORMERS

3—200 KVA 600/220/110
2—2500 KVA 13800/2400/4150

### MOTOR GENERATORS

1—100 KW 550/125V

***Write or wire for additional data and prints.***

**A. LEE ELLIS CO., U. S. Machy. Bldg., 140 Federal St., Boston 10, Mass.**

**The Buyer Must Be Satisfied—Always**

# MOTORS—M. G. SETS—CONTROL

**In Stock—Immediate Shipment—Rebuilt & Guaranteed**

## CRANE & MILL MOTORS

230-V. D.C.

| Qu. | h.p. | Make | Type | R.P.M. |
|---|---|---|---|---|
| 3 | 5 | G.E. | MD-101 | 825 |
| 2 | 6/7½ | Whse. | MC-20 | 725/625 |
| 1 | 6 | G.E. | CO-1805 | 1150 |
| 1 | *9 | G.E. | MD-102 | 975 |
| 1 | 10 | G.E. | CO-2504 | 700 |
| 1 | 14/19 | Cr. Wh. | B. W. | 675/560 |
| 1 | 19 | Cr. Wh. | S. W. S.-15 | 560 |
| 1 | 21 | G.E. | C. O.-2506 | 540 |
| 1 | 25 | G.E. | COM-1828 | 850 |
| 1 | 30/42 | Cr. Wh. | D. W. | 620/520 |
| 1 | 30/45 | G.E. | MD-104½ | 625/500 |
| 1 | 33 | Cr. Wh. | SWS-25 | 500 |
| 2 | 35 | G.E. | CO-2506 | 650 |
| 1 | *40/50 | G.E. | MD-105 | 550/475 |
| 1 | 50 | G.E. | CO-1829 | 750 |
| 2 | *50 | G.E. | COM-1830 | 525 |
| 1 | 50 | G.E. | CO-1830 | 525 |
| 1 | 54/80 | Cr. Wh. | F. W. | 575/480 |
| 2 | 65 | G.E. | CO-1830 | 700 |
| 5 | 65/85 | G.E. | CO-1811 | 600/550 |
| 1 | 70/90 | Whse. | MCA-70 | 450 |
| 1 | 75/85 | G.E. | MD-106 | 500/460 |
| 3 | 85.110 | G.E. | MD-107 | 500/450 |
| 2 | 100 | G.E. | CO-1812 | 600 |
| 1 | *100/140 | G.E. | MD-108 | 500/430 |
| 1 | 100/140 | G.E. | MD-108 | 500/430 |
| 1 | | Whse. | MTA#2 | |

All above series except * compound wound.

### MOTOR GENERATOR SETS

1—10 KW, 250-VDC., 1800-RPM., Sq. Cg. Motor, 220/3/60-Cy.

1—175 KW, 250-VDC., Comp. Interpole, 1200-RPM., 280-HP G.E. syn. motor, 4100/2200/3/60-Cy., complete with A.C. and D.C. panels and starting equipment.

1—3-Unit Set, (2) 70 KW, 40-VDC. Generators, (1) 210-HP. Westghse. Syn. Motor, 440/3/60-Cy., complete with A.C. and D.C. panels and control equipment.

## ADJUSTABLE SPEED MOTORS

| Qu. | H.P. | Make | Type | R.P.M. |
|---|---|---|---|---|
| 1 | ¾ | G.E. | B.D.-225 | 600/1800 |
| 1 | 2 | G.E. | R.F.-7 | 500/2000 |
| 1 | 2 | G.E. | C.D.-55 | 700/2100 |
| 1 | 3½ | Whse. | S.K.-30 | 660/2000 |
| 1 | 3 | Rel. | T-14 | 1200/3600 |
| 1 | 5 | G.E. | R.F.-9 | 450/1350 |
| 1 | 5 | Whse. | SK-33 | 1150/1650 |
| 1 | 6 | G.E. | R.F.-9 | 450/1350 |
| 1 | 7½ | G.E. | R.F.-10 | 450/1350 |
| 1 | 7½ | G.E. | R.F.-10 | 450/1800 |
| 1 | 7½ | Rel. | T-78 | 500/1500 |
| 1 | 7½ | G.E. | C.D.-75 | 600/1800 |
| 1 | 7½ | Whse. | SK-70 | 600/1800 |
| 1 | 7½ | Whse. | SK-60-L | 650/1300 |
| 1 | 8 | Whse. | SK-100-L | 300/1200 |
| 1 | 8½ | G.E. | R.F.-9 | 600 1800 |
| 2 | 9 | G.E. | R.F.-10 | 400/1600 |
| 1 | 10 | Whse. | S.K. | 250/1000 |
| 1 | 10 | G.E. | R.F.-12 | 300/1200 |
| 3 | 10 | Whse. | SK-90 | 400/1600 |
| 1 | 10/15 | Al. Ch. | E.B.-100 | 575/1725 |
| 3 | 15 | G.E. | R.F.-11 | 400/1600 |
| 1 | 15 | El. Dy. | 10-S | 450/1350 |
| 3 | 15 | G.E. | RF-10 | 550/1650 |
| 1 | 15 | El. Dy. | 5-S | 600/1200 |
| 1 | 19 | Whse. | SK-100-L | 600/1200 |
| 1 | 20 | G.E. | RF-12 | 400/1600 |
| 1 | 25 | G.E. | C.D.-128 | 200/800 |
| 1 | 25 | G.E. | R.F.-13 | 400/1200 |
| 1 | 25 | Rel. | T-262 | 500/1500 |
| 1 | 25 | G.E. | RF-11 | 500/1500 |
| 2 | 27½ | El. Dy. | | 450/1350 |
| 1 | 30 | G.E. | C.D.M-105 | 875/1750 |
| 1 | 32½ | Whse. | SK-150 | 400 1200 |
| 1 | 35 | G.E. | RF-14 | 250/1000 |
| 1 | 35/50 | Whse. | SK-160 | 500/750 |
| 1 | 50 | Whse. | SK | 250/1000 |
| 1 | 50/65 | El. Dy. | 30-S | 300/1200 |
| 1 | 60 | Whse. | SK-131 | 500/1500 |
| 1 | 100 | Rel. | T-1050 | 400/1200 |
| 1 | 150/185 | El. Dy. | 75-S | 250/500 |
| 10 | 200/250 | Rel. | 2600-T | 400/800 |

WE CAN SUPPLY WITH THE ABOVE ADJUSTABLE & CONSTANT SPEED MOTORS—Manual—Semi magnetic and manual and fully magnetic AUTOMATIC CONTROL "ENGINEERED TO YOUR SPECIFICATIONS."

## SQUIRREL CAGE MOTORS

3-Phase 60-Cycle

| Qu. | H.P. | Make | Type | Volts | R.P.M. |
|---|---|---|---|---|---|
| 1 | 20 | G E. | I-K | 220 | 565 |
| 1 | 25 | G.E. | I-K | 220 | 600 |
| 1 | 25 | Whse. | CS-567 | 220 | 1160 |
| 1 | 25 | Cent. | AS-30 | 550 | 1155 |
| 1 | 25 | Al. Ch. | | 550 | 1740 |
| 1 | 25 | Burke | | 550 | 1800 |
| 6 | 50 | Whse. | CS | 220 | 900 |
| 1 | 75 | G.E. | I-K | 220 | 1800 |
| 3 | 75 | Cr. Wh. | Q-230 | 440 | 690 |
| 1 | 150 | G.E. | I-K | 440 | 900 |
| 1 | 200 | G.E. | KT-357 | 4600 | 1750 |
| 1 | 200 | G.E. | KT-357 | 2200 | 1750 |

2—20-HP. Westinghouse CS-364Y gear motors, 220/440-V., 3-Ph., 60-Cy., Class I, TE, BB, fan-cooled, 68-RPM.

## SLIP RING MOTORS
## CONSTANT DUTY

3-Phase 60-Cycle

| Qu. | H.P. | Make | Type | Volts | R.P.M. |
|---|---|---|---|---|---|
| 1 | 10 | G.E. | I-M | 220 | 1120 |
| 1 | 10 | G.E. | I-M | 550 | 1150 |
| 1 | 10 | Whse. | CW | 440 | 900 |
| 1 | 20 | G.E. | MT-226 | 220 | 900 |
| 2 | 25 | G.E. | MT-332 | 2200 | 850 |
| 2 | 25 | G.E. | MT-332 | 550 | 900 |
| 1 | 30 | Al Ch. | ANY | 440 | 900 |
| 1 | 40 | Al. Ch. | ANY | 2200 | 435 |
| 1 | 40 | Al. Ch. | ANY | 550 | 450 |
| 1 | 40 | Whse. | CW | 2200 | 1800 |
| 3 | 40 | G.E. | I-M | 600 | 1170 |
| 1 | 50 | Whse. | CW | 2200 | 1800 |
| 1 | 125 | Wag. | BR | 2200 | 1160 |
| 1 | 200 | G.E. | I-M | 2200 | 450 |
| 1 | 250 | G.E. | MT | 2200 | 900 |
| 1 | 300 | Whse. | CW-3 | 2200 | 585 |
| 1 | 300 | Al. Ch. | ANY | 2200 | 514 |
| 1 | 350 | Al. Ch. | ANY | 2200 | 514 |
| 1 | 400 | Whse. | CW-1108 | 2200 | 514 |
| 1 | 400 | G.E. | MT-412 | 440 | 600 |
| 1 | 500 | Al. Ch. | ANY | 440 | 600 |

(Manual or Magnetic Control for starting duty, or reversing or varying speed, can be supplied ENGINEERED TO YOUR SPECIFICATIONS)

# T. B. MAC CABE COMPANY

4312 CLARISSA STREET — PHILADELPHIA, PENNA.

# DIESEL ENGINE GENERATORS

2—American Locomotive, 720 BHP—6 cylinder 12½" bore x 13" stroke, 630 RPM, mechanical injection, 4-cycle Diesel Engine—direct connected to: General Electric 600-KW, 240-volt, direct current, 630 RPM Generator. Complete with switchboard, motor-driven air-compressor, lubricating oil filter, lubricating and fuel oil tanks and many spare parts.

NEW 1944, USED LESS THAN 300 HOURS AND FULL EQUIVALENT OF NEW

## WALTER H. WILMS & COMPANY

**2526 GUARDIAN BLDG., DETROIT 26, MICH.**

**CAdillac 1856-1857**

6—New Deaerating Heaters, capacities 50,000 to 79,000# per hour.

3—New Surface Condensers, 8200 Sq. Ft.

2—New Surface Condensers, 1500 Sq. Ft.

6—New Surface Condensers, 585 Sq. Ft.

6—New Evaporators, 40 tons per day capacity.

6—Air Ejectors, Twin 2-stage, New with inner and after Condensers, for 6000 KW Turbines.

3—Air Ejectors, Twin, 2-Stage, New, With inter and after Condensers, for 4000 KW Turbines.

3—Air Ejectors, Twin, 2-Stage, New, With Inter and after Condensers, for 500 KW Turbines.

6—New Westinghouse variable capacity turbine driven Blowers, 19,000 CFM.

12—New Motor Driven Condensate Pumps.

2—New Main Circulating Pumps, 13,000 GPM, 30' Head.

6—New Main Circulating Pumps, 10,500 GPM, 25' Head.

2—750 KW G.E. 480 Volt Condensing Turbines.

1—200 KW Slightly Used 3 Ph. 60 Cycle 440 V. G. E. Condensing Turbine, 400# Pressure.

2—2500# 257 RPM Slipring Motors.

## SUNDFELT EQUIPMENT COMPANY, INC.

**3422 First Ave. So. Seattle 4, Wash.**

**MAin 1474**

### DIESEL GENERATOR UNIT

**1500 H.P.—1250 KVA**

Nelseco — General Electric
Modern, Supercharged, Bosch Injection
3/60/2400, 300 RPM. All Accessories. Complete
Immediate Stock Delivery Rebuilt

**A. G. SCHOONMAKER COMPANY**
50 Church St., New York 7, N. Y.
Phone Worth 2-0455

### ENGINE GENERATOR SET

250 KW Croc. Wh. D.C. Gen., Com. Interpole, 125 V. 2000 Amp. 150 RPM. D.C. to Erie Ball high speed non-releasing gear Corliss Eng., 4 valve eng. #6772, size 24 x 27, 100# pres. new 1925. Good con.

**PHILA. TRANSFORMER CO.**
2829 Cedar St., Phila., Pa.

### FOR SALE

**Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.**

PENN MACHINERY COMPANY
Jackson, Miss.

# PUMPS

***Rebuilt & Guaranteed***

**PUMPS**—Large stock centrifugal—turbine—piston.

**STEAM PUMPS**—Duplex - Simplex. Reconditioned and guaranteed.

**BOILERS**—stacks—Engine Generators—condensers.

**LOU COHEN**

**PUMP & MACHINERY COMPANY**

**715 Howard St. St. Louis 6, Mo.**

**Telephone - GArfield 4290**

# ALL BRONZE PUMPS NEW CENTRIFUGALS

3—30-45 G.P.M. 30 to 80' Head, 1½" dis. WESTCO Ball Bearing, with Bases and Couplings for motors.

8—30-85 G.P.M. 30 to 87' Head, 1½" dis. WORTHINGTON MONOBLOC—2 H.P. 3 ph., 3450 RPM Tot. Enc. Fan Cooled Motors.

1—150 G.P.M.—60' Head, 1½" dis. Fig. 5530 FAIRBANKS MORSE, with Base and Coupling for Motor.

**IN PHILS. Stock—Immediate Shipment**

**DELTA EQUIPMENT CO.**

**148 N. 3rd St. Phila. 6, Pa.**

# BARGAINS

300 HP McIntosh Seymour 4 cycle 3 cylinder full diesel. 200 RPM 200 KW, GE 2300 volt Generator. Switchboard and accessories. Excellent condition $7500.

25 KW International Ready-Power Portable Generator set, Model UD-14, 900 RPM, 60 cycle 220 volt. Like new. $1500.

**MISSISSIPPI VALLEY EQUIPMENT CO.**

**507 Locust St. St. Louis 1, Mo.**

# BOILERS

2—400 H.P. Erie City, type E stokers, OHIO PENNSYLVANIA & ASME stamping.
2—400 H.P. Springfield sectional header, oil burners, N. J. & ASME stamping.
2—25,000# B & W Stirling's, unit pulverizers, National Board Stamping.

**H. P. BREARLEY**

**3423-91st Street, Jackson Heights, N. Y.**

***NEW***

**SET UP BUT NEVER USED**

3—WORTHINGTON 3½ x 18 horizontal duplex power pumps
3—350 HP, 600 R.P.M. 3 phase, 60 cycle, 2300 volt synchronous motors, with WESTINGHOUSE starters and accessories

**PRICED LOW - FOR QUICK SALE**

***Investigate!***

**Morey Machinery Co., Inc.**

**410 Broome St. New York 13, N. Y.**

# ELECTRICAL EQUIPMENT — REBUILT and GUARANTEED

**MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS**

## HEADQUARTERS FOR D.C. MOTORS!

### 230 VOLT CONSTANT SPEED D. C. MOTORS

| Qn. | H.P. | Speed | Make | Type |
|---|---|---|---|---|
| 22 | 2 | 850 | West. | SK-20 |
| 20 | 3 | 1150 | West. | SK-20 |
| 10 | 3 | 850 | Reliance | T-23T |
| 25 | 3½ | 850 | West. | SK-30 |
| 3 | 7½ | 1750/1310 | West. | SK-43 |
| 2 | 7½ | 1150 | G.E. | CDM-66 |
| 2 | 7½ | 875/1750 | West. | SK-63L |
| 3 | 7½ | 850 | G.E. | CD-75 |
| 5 (new) | 10 | 1150 | Al.-Ch. | EB-80 |
| 1 | 10 | 850 | West. | SK-83 |
| 10 (new) | 12½ | 600 | West. | SK-93 |
| 5 | 15 | 825 | West. | SK-90 |
| 3 | 20 | 1750/1310 | West. | SK-83 |
| 2 | 20 | 1150 | G.E. | RC-30 |
| 11 | 20 | 750 | West. | SK-110L |
| 17 | 25 | 825 | West. | SK-120 |
| 1 | 30 | 750 | G.E. | RC |
| 1 | 40 | 1700 | West. | SK-103 |
| 1 | 40 | 750 | G.E. | RC-34 |
| 1 | 50 | 650 | G.E. | RC-16 |
| 2 | 60 | 1750/1310 | West. | SK-143 |
| 3 | 75 | 850 | West. | SK-160 |
| 1 | 100 | 1150 | West. | SK-163 |
| 1 | 150 | 700 | Al.-Ch. | |
| 2 | 200 | 1150 | G.E. | RC-38 |
| 1 | 250 | 1150 | C.W. | CMC-101A |

### SLIP RING MOTORS—3 Ph., 60 Cy.

| Qn. | H.P. | Speed | Volts | Make | Type‡ |
|---|---|---|---|---|---|
| 1 | 3 | 1750 | 440* | West. | CW-232C |
| 1 | 5 | 580 | 220* | G.E. | HI-9 |
| 6 | 7½ | 810 | 550 | G.E. | MTC-5201 |
| 1 | 7½ (new) | 575 | 220* | G.E. | MT-522 |
| 2 | 10 | 1140 | 440* | West. | HF-7A |
| 2 | 10 | 570 | 220* | G.E. | HI-11 |
| 3 | 11‡ | 810 | 550 | G.E. | ITC-5008 |
| 1 | 15‡ | 900 | 440* | G.E. | MTC-5302 |
| 2 | 15 | 570 | 220* | West. | CW-646 |
| 1 | 18 | 680 | 440* | West. | MW-316 |
| 1 | 20 | 1750 | 440* | West. | CW-471A |
| 1 | 25 | 1130 | 550 | G.E. | MT-323 |
| 2 | 25 | 850 | 220* | Wagner | BR |
| 2 | 25 | 720 | 440* | Wagner | 22VBR |
| 1 | 30 | 865 | 440* | West. | CW-646 |
| 1 | 30 | 850 | 440* | G.E. | MT-332 |
| 1 | 30 | 675 | 440* | G.E. | MT-336 |
| 2 | 35 | 600 | 440* | F-M | HV-H16A |
| 2 | 40 | 865 | 2200 | Al-Ch. | ARY-223C |
| 1 | 40 | 560 | 440* | G.E. | MT-346 |
| 1 | 50 | 860 | 440* | West. | HF-12A |
| 5 | 52‡ | 550 | 220* | G.E. | IQC-5013*** |
| 1 | 60 | 685 | 440* | West. | CW-758 |
| 1 | 60 | 570 | 550 | G.E. | MTC-5546 |
| 1 | 60 | 345 | 550 | West. | CW-930-39 |
| 1 | 75 | 720 | 550 | G.E. | MT-556 |
| 1 | 80‡ | 575 | 440* | G.E. | MTC-5352 |
| 1 | 100 | 1760 | 220* | Al.-Ch. | ARY-223BS |
| 2 | 125 | 430 | 440* | G.E. | IL-16 |
| 2 | 150 | 1750 | 440* | G.E. | MTP-549 |
| 1 | 150‡ | 680 | 440* | West. | CI-856-C |
| 1 | 150 | 490 | 2300 | West. | CW-956A |
| 1 | 150 | 385 | 550 | G.E. | IM-17 |
| 1 | 175 | 505 | 550 | West. | CW-1002 |
| 2 | 200 | 600 | 550 | G.E. | IM-17 |
| 1 | 200 | 495 | 2200 | G.E. | IM-17A |
| 3 | 250 (new) | 360 | 440 | West. | CW-20-53-15 |
| 1 | 300 | 514 | 550 | G.E. | IM-17A |
| 1 | 400 | 505 | 550 | West. | CW |

* Can be furnished for either 220 or 440 volts but not both voltages.
‡ Intermittent rating.

### 230 VOLT ADJUSTABLE SPEED D. C. MOTORS

| Qn. | H.P. | Speed | Make | Type |
|---|---|---|---|---|
| 10 | 1½/2 | 500/200 | G.F. | CD-65 |
| 1 | 2 | 225/900 | Reliance | 7ST |
| 6 | 5/7½ | 600/1800 | G.E. | RA-30 |
| 1 | 10 | 400/1600 | G.E. | RF-10 |
| 1 | 12½ | 280/840 | West. | SK-130 |
| 10 (new) | 12½ | 600 | West. | SK-93 |
| 1 | 15 | 600/1800 | Reliance | T-131T |
| 1 | 15 | 400/1600 | G.E. | RF-11 |
| 1 | 15/20 | 500/1500 | G.E. | CD-95 |
| 3 | 20 | 400/1600 | G.E. | RF-12 |
| 1 | 23/29 | 300/1200 | G.E. | RF-13 |
| 1 | 25 | 500/1500 | Reliance | T-230T |
| 1 | 30 | 400/1200 | West. | SK163 |
| 1 | 35 | 500/1500 | West. | SK-148 |
| 3 | 40/50 | 400/1600 | Al.-Ch. | EB-147 |
| 3 | 40/50 | 400/1600 | Reliance | T-385T |
| 1 | 75 | 500/1500 | Cr.-Wh. | CCM |
| 5 | 100 | 400/1200 | Al.-Ch. | |
| 3 | 100 | 320/960 | West. | SK-200 |
| 1 | 175 | 230/750 | West. | SK-220 |
| 2 | 375 | 350/500 | G.E. | MPC |

### CRANE, MILL TYPE 230 VOLT—D. C. MOTORS

| Qn. | H.P. | Speed | Make | Type |
|---|---|---|---|---|
| 2 (115 v.) | 3½ | 700 | G.E. | CO-1803 |
| 2 | 5½ | 760 | West. | MCB-20 |
| 1 (new) | 10 | 650 | G.E. | MD-403-BE |
| 2 | 10 | 690 | West. | K-4 |
| 1 | 13 | 575 | G.E. | CO-1806 |
| 1 | 15 | 630 | West. | K-5 |
| 2 | 20 | 515 | West. | K-6 |
| 3 | 25 | 590 | Diehl | TE |
| 2 | 27 | 490 | West. | MC-40 |
| 3* (new) | 35* | 600 | West. | CK-9 |
| 1 | 50 | 600 | West. | CK-9 |
| 5** (new) | 50** | 525 | G.E. | COM-1830AE |
| 1 | 59 | 470 | G.E. | CO-2007 |
| 2 (new) | 60 | 550 | G.E. | COM-1831AE |
| 4 | 65 | 450 | G.E. | COM-1830 |
| 1 | 70 | 440 | West. | MC-70 |

* Available with West Type DW Frame 135F, Style 487555, Shunt Wound Brakes.
** Available with G.E. CR9523B313M2. Cat. 823043-G24 Shunt Wound Brakes.

### SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

| Qn. | HP | Speed | Volts | Make | Type |
|---|---|---|---|---|---|
| 1 | 15 | 3485 | 220* | Reliance | AA-B3247 |
| 2 | 20 | 1160 | 440* | West. | CS-554 |
| 1 | 25 | 1140 | 2200 | West. | CCL |
| 1 | 25 | 705 | 440* | West. | CS-W504-TEFC |
| 1 | 25 | 690 | 440* | G.E. | KT-336 |
| 1 | 30 | 870 | 220* | West. | CS-646 |
| 1 | 30 | 1160 | 440* | West. | CS-644 |
| 1 | 50 | 900 | 2200 | G.E. | KT-346 |
| 1 | 50 | 850 | 220* | West. | CCL |
| 1 | 75 | 1750 | 2200 | West. | CS-761 |
| 1 | 100 | 495 | 2200 | Al.-Ch. | AN |
| 1 | 100 | 580 | 2200 | G.E. | IK-15 |
| 2 | 100 | 500 | 2200 | West. | CS-930 |
| 3 | 150 | 1800 | 440* | Howell | N-684 |
| 4 | 200 | 580 | 550‡ | G E. | KT-566S |
| 1 | 700 | 1800 2300/4000 | | West. | CS-4-39D-12 |

* Can be furnished either 220 or 440 volts, but not both voltages. ‡ Reconnectable for 440 volts.

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| Qn. | HP | Make | Type |
|---|---|---|---|
| 15 | 1 | G.E. | K-203 |
| 15 | 2 | G.E. | K-224 |
| 15 | 3 | G.E. | K-225 |
| 15 | 5 | G.E. | K-254 |
| 10 | 7½ | Al.-Ch. | AR-284 |
| 7 | 7½ | G.E. | K-284 |
| 6 | 10 | G.E. | K-324 |
| 2 | 20 | G.E. | K-364 |

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1— 40 HP Leffel Scotch Marine Boiler 125#

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1—6250 KW General Electric, 1800 RPM, Condensing, all auxiliaries.
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1—500 KW General Electric Condensing Turbine
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1—360 KW Chicago Pneumatic—480 Volts—New.
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1—27"x36" Skinner Uniflow, direct connected to 562 KVA AC Generator, complete.
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1—375 KVA Harrisburg Uniflow Engine Generator.
1—28"x36" Hamilton Uniflow direct connected to 750 KW, 3-60-2300 volts, all auxiliaries.
1—450 KW Skinner Uniflow Engine Generator, 2300 volts, 14 years old.

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Lane 60' Span
Shaw 80'9" Span
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| HP | Volts | Make | Speed |
|---|---|---|---|
| 300 | 440 | Al. Chal..... | 900 |
| 250 | 2300 | G.E. | 600 |
| 350 | 440/550 | G.E. | 600 |
| 200 | 2200/440 | G.E. | 600 |
| 150 | 2200/440 | G.E. | 600 |
| 125 | 440/220 | G.E. (Hoist) | 900 |
| 100 | 440/220 | G.E. MTC | 900 |
| 100 | 550 | G.E. | 900 |
| 80 | 440/220 | G.E. (MTC) | 900 |
| 75 | 440/220 | G.E. (MTC) | 900 |
| 60 | 440/220 | G.E. | 1200 |
| 50 | 2200/440 | G.E. | 600 |
| 75 | 550 | G.E. | 900 |
| 40 | 2200 | Whse. | 900 |

## SYNCHRONOUS MOTORS

3-PH., 60 Cy.

| HP | Volts | Make | Type | RPM |
|---|---|---|---|---|
| 600 | 4000/2300 | Cr. Wh. | SYN. | 900 |
| 500 | 4000/2300 | Cr. Wh. | SYN. | 900 |
| 500 | 400/220 v. | G.E. | TS | 900 |
| 300 | 440/220 | G.E. | ATI | 600 |
| 300 | 4150/2300 | Cr. Wh. | SYN. | 900 |
| 300 | 440/220 | Al. Ch. | | 600 |
| 250 | 4000/2300 | G.E. | TS | 1200 |
| 240 | 2200 | G.E. | ATI | 600 |
| 200 | 4150/2300 | Whse. | G | 1800 |
| 200 | 2200 | G.E. | ATI | 514 |
| 150 | 4150/2300 | G | G | 1800 |
| 150 | 440/220 | G.E. | ATI | 900 |
| 150 | 2200/440 | G.E. | TS | 600 |
| 125 | 2300 | G.E. | TS | 327 |
| 110 | 440/220 | G.E. | TS | 1800 |
| 100 | 440/220 25 cy. | G.E. | TS | 375 |
| 100 | 440/220 | Whse. | G | 1800 |
| 90 | 440/220 | G.E. | ATI | 1200 |

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## SQUIRREL CAGE MOTORS

| HP | Volts | Make | Type | Speed |
|---|---|---|---|---|
| 500 | 440/220 | G | K | 1200 |
| 500 | 440/220 | G.E. | IK | 900 |
| 400 | 550 | G.E. | IK | 720 |
| 350 | 440 | G.E. | IK | 900 |
| 300 | 440/220 | G.E. | IK | 720 |
| 200 | 440/220 | Whse. | CS | 600 |
| 200 | 440/220 | G.E. | KT | 600 |
| 200 | 2200/550 | Al. Ch. | AR | 900 |
| 150 | 440/220 | Howell | B. Brg. | 1800 |
| 125 | 2200 | G.E. | KT | 600 |
| 100 | 440 | G.E. | IK | 450 |
| 100 | 2200 | G.E. | KT | 511 |
| 75 | 2200 | G.E. | IK | 1800 |
| 74 | 2200 | G.E. | KT | 900 |
| 50 | 2200 | Al. Ch. | | 720 |
| 50 | 550 | Whse. | CS | 3600 |

## A. C. GENERATORS

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1—450 kva., 900 rpm., 4000/2300 v., Cr. Wh.
1—300 kva., 900 rpm., 4000/2300 v., Cr. Wh.
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1—150 kva., 900 rpm., 440/220 v., G.E.
1—100 kva., 327 rpm., 2300 v., G.E.
1— 98 kva., 1800 rpm., 440/220 v., G.E.
2— 75 kva., 1800 rpm., 440/220 v., Whse.
2— 75 kva., 1200 rpm., 440/220 v., G.E.
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## MOTOR GENERATOR SETS

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3—150 kva. Whse., 11000-2300 volts.
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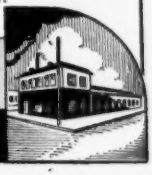

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1—2250 KVA, 3 phase, 60 cy., 3600 RPM, Gen. Elec. Turbo Generator, steam pressure 410 lbs. 275° S.H. 725° T.T. with surface condensor.
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285 new Gen. Elec. transformers 3 to 75 KVA, 450 to 117 vlts.
68 new Gen. Elec. transformers 3300-6600-11000 to 120-240 vlts type HSBA.
1—150 K. W. 125 volts 400 RPM Crocker-Wheeler compd wound interpole Generator to a 4 cylinder, vertical unaflow Ames engine.
1—360 HP Anderson full diesel, Model 29 257 RPM with clutch and pulley on one end to drive an ice machine or any other machine and a 125 KVA, 3 phase, 60 cycle, 240 volt Generator direct connected on opposite end.
1—90 KVA, 3 ph., 60 cy., 2300 V, Fairbanks Morse Generator connected to a 2 cylinder Fairbanks Morse full diesel type Y, style VA.
1—156 KVA., 3 ph., 60 cy., 240 volt, 1200 RPM, type ATB frame 9635 General Electric connected to an 8 cylinder Buffalo Gasoline engine.
1—1000 K.W. 3 ph., 60 cy., 480 volt, 3600 RPM, General Electric Generator to a General Electric turbine 180 lbs steam pressure 40 lbs back pressure.
1—300 KW, 3 ph., 60 cy., 440 vlt. 3600 RPM Westinghouse Generator only.
7—500 amp. 6 V direct current to 3 ph., 60 cy., 220 vlt. General Electric rectifiers.
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1—50 KW, 250 volt Gen. Elec. to a 75 HP 3 phase, 60 cycle, 440 Vlt. General Electric motor.
A large number of new 115 volt direct current ball bearing General Electric motors 5 to 20 HP.
1—1500 KW, 250 vlt., 600 RPM Westinghouse rotary converter complete with transformers and switchboard.

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## Power Plant Equipment Company

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# UNUSED GASOLINE GENERATOR SETS

4—3 KW, AC, 1 ph., 60 cyc., 115 v. Wisconsin Motor. Spare Parts.
2—7½ KW, Master Vibrator Co., 1 hp., 60 cycle., 120/240 v., 1800 RPM, D.C. Wisconsin Engine. Spare Parts.
2—15 KW, Synchronous "O'Keefe-Merritt" 3 ph., 60 cyc., 220/127 v., 4 wire, 1800 RPM. Continuous Duty. Mounted on Skids. Spare Parts.
1—10 KW, Kohler Co., AC, 1 ph., 60 cyc. 115/220 v., Waukeshaw 4 cycl. Water cooled engine. Skid mounted, sheet metal housing. Spare Parts.

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One (1) 750 H.P. Union Boiler, 250# pres.
One (1) Steel Stack with Breeching.
Westinghouse 7 Retort Stoker.
Forced Draft Fan Turbine Drive
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Aldrich Pump Co. Vertical Triplex HYDRAULIC PUMPS, 2-¾" x 8", equipped with Herringbone Gears, 67.5 gpm. Maximum pressure for intermittent duty 2,200 lbs., for continuous duty 1,800 lbs. Pump and motor mounted on common bed plate. Motors are 75 HP, 3/60/220-440 volts, 740 RPM. Complete with starting panel, consisting of G. E. motorstarter switch, push button control, square "D" Switch, and capacitator. Purchased new 3-½ years ago. Excellent condition. Available for immediate delivery.

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(1) New Substation, Indoor, Type Electrical transformer, Mfgr., General Electric Co. Consisting of (1) 667 KVA single phase, pyranel filled 4160 V. primary 60 cy. to 2300 V. secondary power transformer, secondary winding having 8 taps equally spaced from 1150 to 2300 V. (1) loose connected electrically operated secondary Air-Circuit Breaker for control. (6) EJ-1 fuses. (1) closing device. (3) sets gaskets. (2) Gal. Pyranol. (3) sets Pothead Acc. (1) transfer truck. (1) test plug. (1) control power transformer. (1) handle. (2) task coupler. (1) ammeter. Bolts, nuts, washers, etc. Packed 1 skid, 4 crates, 1 box. Floor space 6' x 6' x 98 H. Weight 24500#.

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We Have Just Purchased (NEW, NEVER USED) and Offer For
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**6—UNUSED DC., WESTINGHOUSE 300-KW., 450#-psi., 750°. TT., 3-WIRE, 250-V. TURBINE—GENERATORS**

***PRICED FOR QUICK SALES:***

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***Engineers***

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**FOR SALE**

1—60 HP Chicago Pneumatic horizontal, semi.

1—75 HP F-M full diesel.

2—100 HP F-M, 2 cylinder, vertical, semi.

1—200 HP Worthington, 4 cylinder, full diesel.

Several with
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6—10 ft. x 32 Horizontal 18,000 gal.
9—8 ft. x 45 ft. Horizontal, 17,000 gal.
30—10,000 Gal. Cap. Horizontal.
250—4,000 Gal. Cap. Vertical.
7—42,000 Gal. Cap. Vertical.
3—5,000 & 10,000 Bbl. Cap. Vertical.

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2—400 HP, 6 cylinder Busch-Sulzer diesel engines, air injection, direct connected to 338 KVA, 2300 volt, 3 phase, 60 cycle 360 RPM Westinghouse generators

2—Dual gas engines units each consisting of 2—250 HP, 4 cylinder, 257 RPM Bruce McBeth engine direct connected on both ends of 435 KVA, 2300 volt, 3 phase, 60 cycle Westinghouse generator

1—150 HP, 4 cylinder, 275 RPM, Hope gas engine direct connected to 125 KW, 230 volt, 3 phase 60 cycle General Electric generator

**Each of the above units complete with exciters, switchboards and all necessary starting equipment.**

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LARGEST STOCK OF A.C. AND D.C. MOTORS FROM 5 TO 200 H.P.
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Motors, Generators, Alternators, Frequency Changers.
141 GRAND ST. — CAnal 6-6138 — NEW YORK CITY

## BRAND NEW MOTORS IN STOCK!

**220/440-VOLT, 60-CYCLE, 3-PHASE**

| Qu. | H.P. | Make | Type | Spd. | Descript. |
|---|---|---|---|---|---|
| 22 | ¼ | G.E. | K 47 | 3450 | 440 vlt. only BB |
| 50 | ½ | Wal. Tur. | capacitor | 1750 | 1 ph. 110/220 v. BB open |
| 25 | ½ | Scott | capacitor | 1725 | 1 ph. TEBB |
| 47 | ½ | Wagner | frame 204 | 900 | Cl. 2. Gr. G. TEBB Ex. Proof |
| 30 | ½ | Emerald | | 1200 | open, BB |
| 40 | ½ | Shelby | | 1800 | BB |
| 11 | ¾ | G.E. | | 150 | TEBB gearhead |
| 1 | ¾ | B & B | single phase | 1750 | 110/220 v. spl. proof. BB |
| 8 | ¾ | Wagner | | 1800 | 110/220 v. 1 ph |
| 20 | ¾ | B & B | | 1800 | 110/220 v. 1 ph |
| 15 | ¾ | Shelby | | 1800 | BB |
| 1 | 1 | F-M | QZE 204 | 1150 | TEBB |
| 61 | 1 | Marathon | Ts 203 | 1800 | open dp pf BB |
| 30 | 1 | Marathon | Ts203 | 1800 | Ts BB |
| 14 | 1 | G.E. | K 204 | 1140 | open, BB |
| 1 | 1 | Al. Ch. | fr. 204 | 1750 | splash pf., BB |
| 35 | 1 | Shelby | | 1800 | BB |
| 33 | 1 | Shelby | | 1200 | BB |
| 2 | 1½ | Delco | fr. 254 | 900 | BB open |
| 2 | 1½ | Lima | fr. 224 | 1150 | splash pf., BB |
| 1 | 1½ | G.E. | fr. 203 | 3450 | open, BB |
| 9 | 1½ | Emerald | | 1800 | |
| 20—1½ HP All. Chal. Class 1 Group D explosion proof 220/440 volt, 60 cycle 3 phase 1800 speed. | | | | | |
| 1 | 2 | Century | SC 224 | 1740 | open, BB |
| 2 | 2 | Lima | RS 224 | 1800 | splash pf., BB |
| 7 | 2 | West. | CSP 225 | 1150 | open, BB |
| 1 | 2 | Star | fr. 254 | 900 | open, BB |
| 1 | 2 | Star | fr. 224 | 1750 | TEFCBB |
| 5 | 2 | Star | fr. 224 | 1740 | TEFCBB |
| 11 | 2 | Star | fr. 254 | 1140 | TEBB |
| 3 | 2 | Baldor | | 1200 | TEFCBB |
| 1 | 2 | G.E. | K 204 | 3450 | open, BB |
| 8 | 2 | Emerald | | 1800 | |
| 25—2 All. Chal. Class 1 Group D explosion proof 220/440 volt, 60 cycle 3 phase 1800 speed. | | | | | |
| 4 | 3 | Reliance | fr. 254 | 1140 | open, BB |
| 1 | 3 | G.E. | K 254 | 1140 | open, BB |
| 2 | 3 | Reliance | fr. 284 | 900 | open, BB |
| 4 | 3 | West. | CSP 254 | 1150 | open, BB |
| 8 | 3 | Star | fr. 254 | 1140 | open, BB |
| 4 | 3 | Howell | fr. 254 | 1140 | splash pf., BB |
| 1 | 3 | Delco | fr. 225 | 1750 | TEFCBB |
| 2 | 3 | G.E. | fr. 224 | 3450 | TEFCBB |
| 1 | 3 | G.E. | fr. 254 | 1140 | open, BB |
| 1 | 5 | F-M | QZC 254 | 1725 | TEFCBB |
| 3 | 5 | Al. Ch. | ARZ 284 | 1140 | TEFCBB |
| 2 | 5 | Star | fr. 254 | 1750 | TEFCBB |
| 1 | 5 | I. A. | fr. 254 | 1140 | TEBB |
| 1 | 5 | Diehl | DIF | 1135 | TEFCBB |
| 9 | 5 | G.E. | fr. 284 | 1140 | open, BB |
| 13 | 5 | G.E. | fr. 254 | 1750 | open, BB |
| 5 | 5 | West. | CS 254 | 1800 | BB |
| 6 | 7½ | Louis Allis | OGX 284 | 1740 | open, BB |
| 3 | 7½ | Al. Ch. | ARZ 324 | 1140 | TEFCBB |
| 1 | 7½ | Delco | fr. 324 | 1135 | TEFCBB |
| 5 | 10 | West. | CS 324 | 1750 | open, BB |
| 1 | 10 | G.E. | KG 324 | 1750 | op, BB hi torq. |
| 1 | 30 | West. | CS 365S | 3600 | SSB |

***We have many more motors in stock—may we have your inquiries?***

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*Equipment Co.*

**373 South Goodman St.**
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**ALL SIZES, VOLTAGE AND CYCLES**

**3 ph. 60 cy. A. C. Motors**
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**PUT ALL IDLE EQUIPMENT TO WORK. SEND YOUR LIST FOR PROMPT ACTION.**

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## *FOR IMMEDIATE DISPOSAL*

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# TURBINE-ELECTRIC GENERATING PLANT

**Now located in East Newark, N. J.**

Turbine—7500 KVA, G. E., 175 pound pressure, condensing, 1800 rpm, Form T.
Generator—7500 KVA, G. E., 1800 rpm, 600 volts, 3 phase.
Exciter—steam driven, Allis Chalmers, 250 rpm, 120 volts.
Transformers—4-1250 KVA, G. E., 550 volts to 6600 volts, Type H.
Alberger Condenser and all other necessary auxiliaries.

***For Further Particulars and Inspection write***
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## FOR SALE

**4—50 KW Murphy Diesel Generating sets, 6 Cyl., 4 cycle, 1200 RPM, Elec. Start, Elec. Machy Co. Alternators, 3/60/120/208 volt, including radiator and panel mounted on fabricated steel base.**

**3—50 KW Caterpillar Diesel Generating Sets, 6 Cyl., 4 cycle, 900 RPM, Model D8800, direct con. to: 3/60/120/208 volt generators.**

**3—75 KW Caterpillar Diesel Generating Sets, Model D13000, 3/60/120/208 volt, mounted on steel base, including radiator. All reconditioned.**

**New Chrysler Diesel Power Units, 75 HP Model IND-3, 6 cyl., Elec Start, includes: 4 Batteries, Radiator, and Spare Parts.**

**ALJOHN DIESEL CO., INC.**
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***Sterling 3-6515***

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10 to 1000 H.P.
NEW-USED
RECONDITIONED

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**1—150 HP Ames H.R.T.—ASME 125# Pressure—New 1935—complete with iron fireman overfeed stoker.**
**Price $1300—where is**

**2—150 HP Ames H.R.T.—ASME 150# Pressure—includes stack**
**Price $1250 ea.**

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**1—International Steel Water Tube—Fire Box Boiler built for 125 pound pressure A.S.M.E. rated at 200 Horse Power new in 1939. Excellent condition, can be seen in service. Complete with Flynn & Emrick stoker and Ingersol Rand motor driven boiler feed pump. Available in thirty days.**

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## BOILER & A. C. TURBO-GENERATORS

**2—938 Kva Westinghouse Electric Company's A.C. Turbo-Generators, 3600 R.P.M., 400 P.S.I., 5480 F.T.T., 60 F.S.I. exhaust, non-condensing, 480 volts, 80% P.F., 60 cycle, 3 phase, exciter 11.5 maps., 125 volts. S.O. 2-G-454, serial No. 8043857 and 8043858. Purchased 1929. Used for standby service since 1938.**

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**FREDERICKSBURG, VIRGINIA**

## Rebuilt Power Transformers

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28— 3 KVA Whse. 6000 to 115/230 (new)
3—50 KVA G. E. 33000 to 2300 V.
5— 100 KVA G. E. 22000 to 220/110 V.
6— 200 KVA Whse. 11000 to 440/220 V.
2— 400 KVA Al. Ch. 66000/2300/4000 Y.
6— 500 KVA G. E. 13200 to 575 V.
6— 500 KVA Whse. 24000 to 220/110 V.
2— 667 KVA Pack. 11000/22000 to 440 V.
2— 667 KVA G. E. 33000 to 440/220 V.
2—1200 KVA Whse. 66000/2300/4000 Y.
2—2000 KVA Whse. 66000 to 2200 V.
3—2000 KVA G. E. 13200/26000 to 2300 V.
2—2000 KVA Whse. 33000 to 11000 V.
3—2000 KVA G. E. 33000 to 13200/6600 V.
7—4000 KVA G. E. 15950/27600 Y to 13800/6900/4160 V.

**THREE PHASE**

3— 450 KVA G. E. 66000 Y to 440 V.
6— 650 KVA G. E. 13200 to 2300 V.
1—1200 KVA Whse. 6600 Y to 2300 V.
2—1500 KVA G. E. 13200 to 440 V.
3—1800 KVA G. E. 13200 to 550 V.
1—3000 KVA G. E. 11600 to 440 V.
1—15000 KVA Pitts. 27880 to 4560Y. V.

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3—1500 KVA Al. Ch. 33000 to 13200/6600 V.
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7— 675 KVA Whse. 33000 to 2200 V.

**PYRANOL**

1—3000 KVA Penna. 25 Cy. 13800 to 480 V. 3 Ph.
19—37½ KVA Penna. 440 V. to 220 V. 60 cy. 3 ph.

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19—150 KVA G. E. type Ht, late type, oil or pyranol cooled, 3 ph., 60 cy., 27060/125/216Y Vault or submersible type; attached to each transformer is G. E. automatic heavy duty network protector type MG-6 and heavy duty primary switch; complete with all accessories.
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4—68 KW indoor type Westinghouse constant current regulators, Type R.S., Prim 2200 V., 60 cy., Amp. 6.6 & 7.5 Serial Number 582020

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1—489 H. P. Heine Box Header Water Tube Boiler complete with Suspension Steel, Hand Fired Grates, All Catalogue Trimmings—Extra Equipment. Re-tubed in 1940. ASME, National Board and Pennsylvania Standard, 165# W. P.

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**These are exceptional buys and are now under active Certificate. Inspection can be made at any time.**

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**25 cy. 60 cy. D.C.**

**ALL VOLTAGES 1-1500 H.P.**

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1—80 HP. 1200 RPM, CR. WH. 220/440/3/60 Ind.
1—75 HP. 1800 RPM U.S. Line Start 220/440/3/60 Ind. B.B.
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5—5 HP. 2200 RPM Reliance, Ex. Proof, 230 V. DC.
1—Lot Whse. Type SK, 230 V. DC.
Other AC & DC Motors in Stock.
Cross Line & Reduced Voltage Starters.

## TURBO ALTERNATORS

Complete with Auxiliaries and Control Equipment.
1—3650 KVA 3600 RPM, 2300/3/60, Whse.
1—3125 KVA 3600 RPM, 2300/3/60, Whse.

## MOTOR GENERATOR SETS

1—150 KW Ridgeway, 900 RPM, 250 V. D.C. to 225 HP. 2300 volt. Syn. complete with control equipment.
1—200 KW, 900 RPM, 250 volt DC to 300 HP, 2300/4000 volt Syn. motor AC complete with control equipment.

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1—200 KVA Kuhlman, Cont. Duty, Auto, 3800-2300/3/60.
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**SYNCHRONOUS ROTARY CONVERTERS**

| 6 phase, 60 cycle | | | | | | 1 | 300 | G.E. | 1200 | 600 | # |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Qu. | KW | Make | Speed | DC V. | Trans. V. | 1 | 300 | Whse | 1200 | 275 | # |
| 1 | 500 | Whse | 1200 | 600 | # | 2 | 175 | Whse | 1200 | 275 | 2300/4160 |
| 2 | 300 | Whse | 1200 | 600 | # | 1 | 175 | G.E. | 1200 | 275 | # |

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**38—Reliance 1¼ H.P. Variable Speed Motors**

**110 Volts D.C., 600/1800 RPM**

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**A COMPLETE PLANT**—940 KVA Wghse. 3-60-2300 or 480 v. Cond. Turbo Generator Set. Also two 250 HP. Murray WT Boilers, with Foster Superheaters and oil burners. 200# pressure. Completely overhauled, with turbine rebladed.

**375 KVA GE-Worthington diesel engine;** with dir. con. exciter and switchboard.

**1875 KVA GE** 3/60/2300 V. condensing Turbo Unit; Surface condenser, etc.

**110 KVA Al. Chal. 3-60-240 v. alternator** with Elliott non-cond. turbine, exciter and switchboard.

**750 KVA GE** 3/60/2300 V. condensing Turbo Unit; condenser, etc.

**90 KVA** and 185 KVA Fairbanks Morse Diesel Units; Model 32E14.

**Natural Gas Unit.** 375 KVA, GE. 3/60/480 240 V. with Cooper Bessemer Gas Engine with dir. con. exciter and switchboard. "Overhauled."

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*FOR SALE*

**General Electric 11,000-229 Voltage Rating, Type W.C.T. Electric Furnace Transformer**

***New 1943—Used 3 Months***

**RATING 2,000 KVA. CONTINUOUS 55° C., TAPS RANGING 229 VOLTS to 85 VOLTS. S. V. AMPS. 105 TO 47. SERIAL #7024598.**

***For full specifications and price—write, wire, phone***

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**BOILER**

One new 300 H.P. Wickes 3 drum water tube water wall boiler for 200# working pressure. ASME design. Capable of 200% operation. For stoker, gas and oil firing. Complete with all standard boiler trimmings. Just delivered; never installed. Ready for immediate shipment.

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800 GPM Marley Cooling Tower New Worthington 200 GPM Pump and Turbine. 95 ft. 3 ply 52½" Leather Belt.

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Leavenworth, Kansas

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**Turbine:** Moore type S2R designed for 100 KW at 4000 RPM with steam at 250# initial pressure, 100° superheat and exhausting to 2# back pressure. Equipped with standard mechanical constant speed governor with hand speed changer, and standard accessories.

**Gear:** Size 6¾ x 6, speed 4000/1200 RPM.

**Generator:** 1200 RPM, 3 phase, 60 cycle, 240 volt, with silent chain driven excitor.

**Couplings:** High speed and low speed.

**Baseplate:** Under complete unit.

**Control Panel with the following Equipment:**
3-Pole oil circuit breaker G.E.-P.L. 87821 — #15933 USN-8394.
Ammeter Thomson type, 0 to 400 amps with current transformers type DB-6.
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Tirrel Voltage Regulator, G.E. #4097. Type 125, 25-125 cycles.
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*All the above in first class condition and at a bargain price.*

**TAYLOR INSTRUMENT COMPANIES**
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**135,000 Lbs.**

¾" x 9" x 20'; hard drawn in original burlap wrappings $.3365/lb.—f. o. b. Arkansas

**Salvage Division**

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Richmond, Virginia

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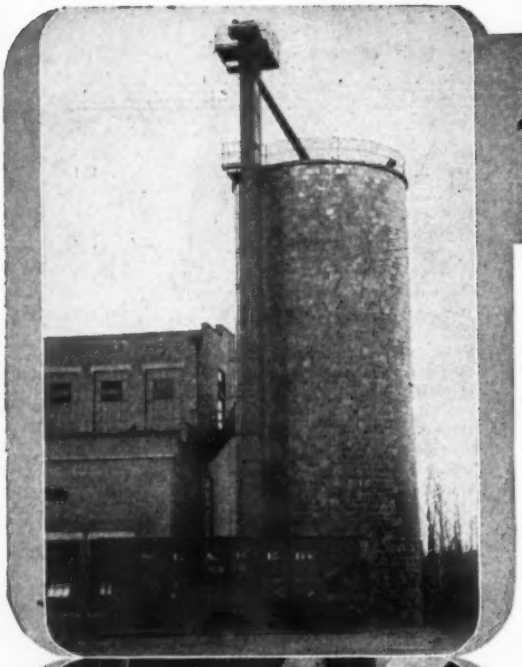


*Where space is limited*

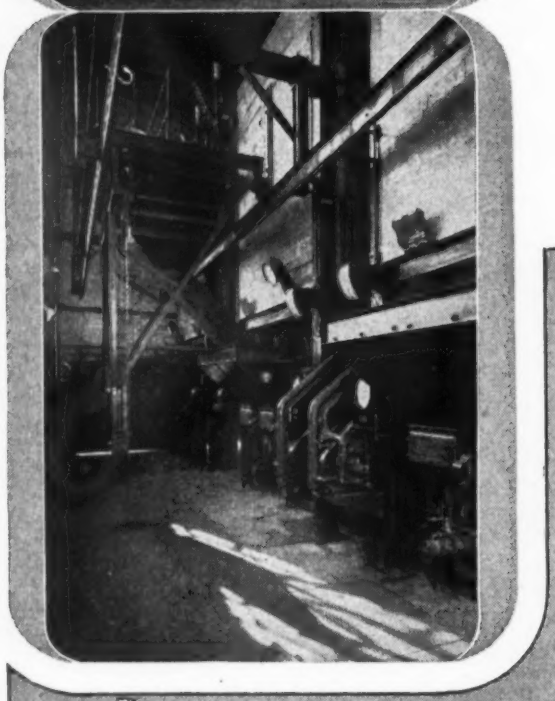
# FAIRFIELD
## COAL HANDLING SYSTEM

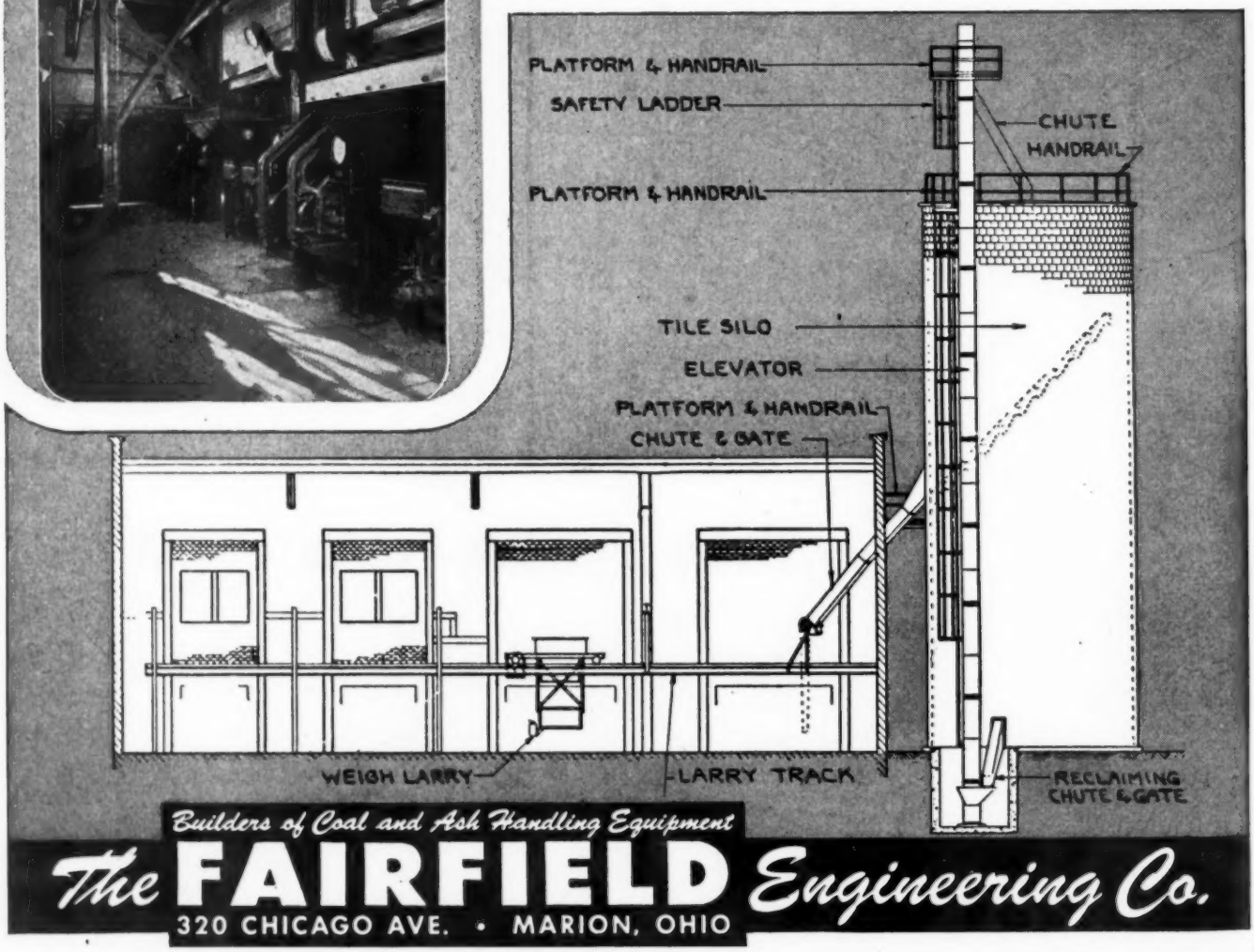
• The Fairfield Silo System is an efficient and economical method of storing and reclaiming coal, particularly for boiler plants requiring 200 to 1,000 tons coal storage. Silos are ideal where space is limited as their circular construction takes up minimum space and provides maximum storage facilities.

For example, the plant shown takes up very little space and handles 30 tons of coal per hour. It provides automatic handling of coal from car to silo to weigh larry.

In this, as in all Fairfield installations, the equipment was designed—built—erected to meet the operating and physical conditions of the boiler plant.

Fairfield Engineers will gladly help you determine the most efficient and economical coal handling system for your plant. Write us today for complete details.






*Builders of Coal and Ash Handling Equipment*

**The FAIRFIELD Engineering Co.**

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The kind of engineering and practical piping experience that makes possible the development of pipe hangers for extreme cases is applied to every Grinnell Pipe Hanger. From simple supports for household water piping to constant-support suspensions for super-pressure piping, Grinnell Hangers are built to do their jobs correctly and economically.

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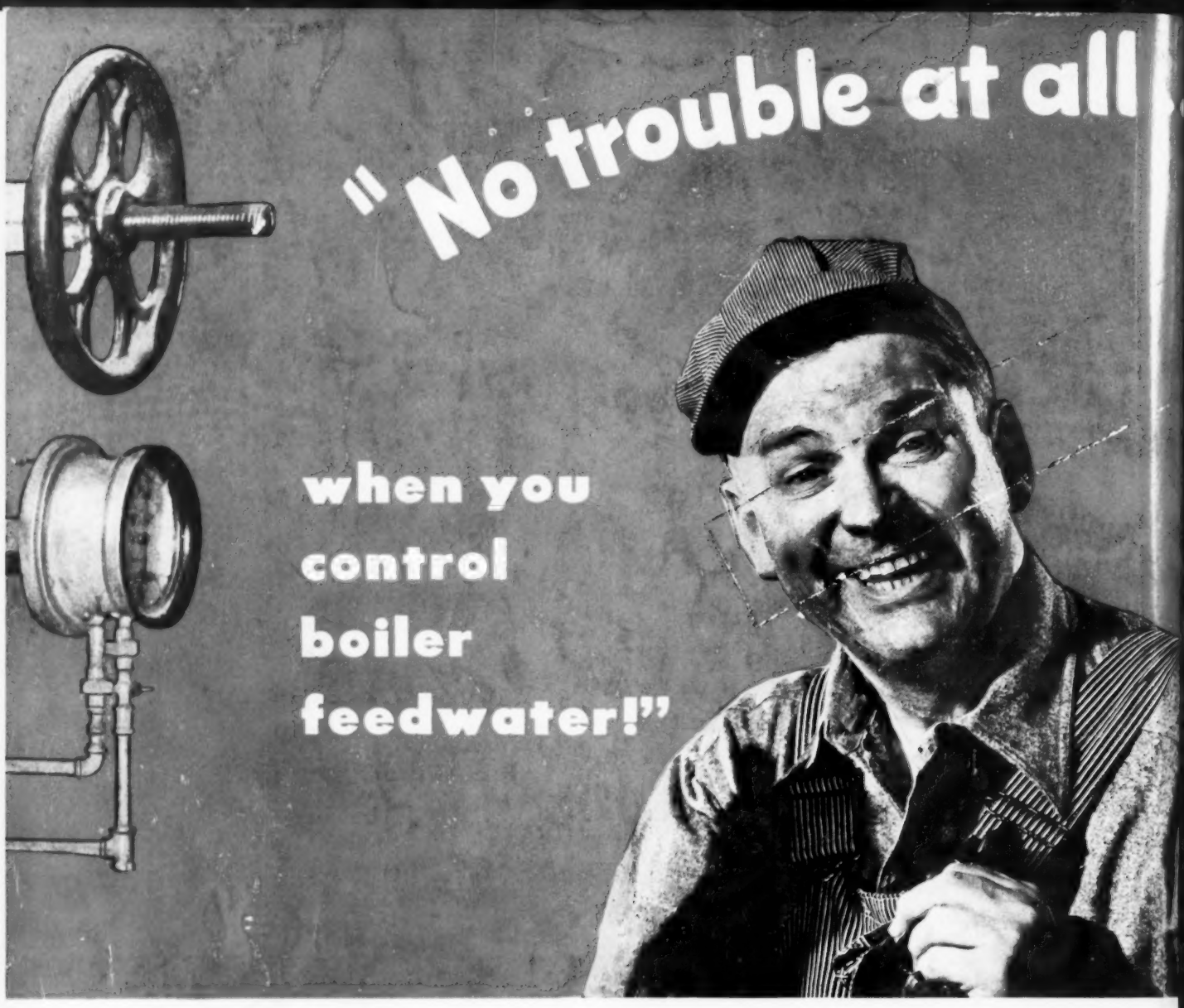
WHENEVER **PIPING** IS INVOLVED



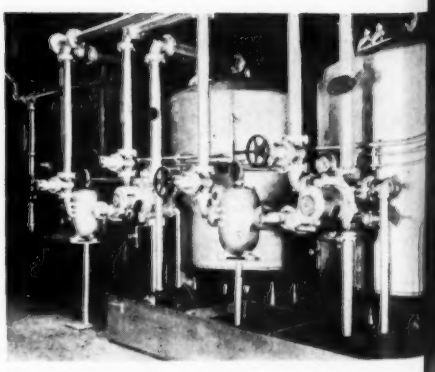

# How Permutit helps prevent boiler scale and corrosion

There's no chance for impurities in feedwater to cause scaling, corrosion of boilers and steamlines—and even more serious trouble—if a plant is Permutit* protected. Permutit *removes* these impurities before the water enters the boilers!

Manufacturers of water conditioning equipment for over 30 years, Permutit provides *every* process for control of water quality—Zeo-Karb Water Softeners (illustrated), Hot and Cold Lime Soda Softeners, Deaerating Heaters as well as Continuous Blowoff and Demineralizers that deliver a low-cost substitute for evaporated water.

It's no trouble at all to keep boilers *clean as new metal*—with Permutit Water Conditioning. Write, outlining your water problem, to The Permutit Company, Dept. P7, 330 West 42nd Street, New York 18, N. Y. or Permutit Co. of Canada, Ltd., Montreal.

*Trademark Reg. U. S. Pat. Off.



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